Tytti Arola

Ihmiskehonjatkesoittimet

Instruments extending the body in sonic performance

creation and development of
three tangible string instruments
for performative sound art

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Tiivistelmä
Ihmiskehonjatkesoittimet on taiteellinen tutkimus ihmiskehoa jatkavista soittimista. Tutkimuksen lähtökohtana on tutkia, että voiko soittajan ja soittimen välistä yhteenpunoutunutta suhdetta korostaa kehoa jatkavien soitinten avulla. Kirjoittajan omat kokemukset muusikkona taustoittavat tutkimuksessa esiteltyjä teoreettisia pohdintoja soittamisen ergonomiasta. Tämän lisäksi teoreettisessa viitekehyksessä kontekstualisoidaan tutkimusta tutustumalla muihin soittimiin ja taideteoksiin, jotka ovat inspiroineet maisterityötä.

Tutkimus perustuu kirjoittajan pohdintaan liittyen soittimien suunnitteluun ja rakentamiseen sekä niiden kanssa harjoitteluun ja esiintymiseen. Tutkimuksen aikana kerättyä laajaa dokumentaatioaineistoa on käytetty työkaluna prosessin muistiin palauttamisessa sekä projektin kuvaamisessa lukijalle.

Tutkimukselle asetettiin kaksi tavoitetta: (1) fyysisesti kehoa jatkavien soittimien rakentaminen kestäviksi ja kekseliäiksi, ja (2) esiintymistaitojen kehittäminen tarkastelemalla soittimia performanssitaiteen näkökulmasta. Tutkimuksen tulokset tukevat asetettuja tavoitteita. Jokainen soitin on rakennettu eri näkökulmasta ja niitä soitetaan eri tavoin – soittimet tarjoavat laajan näkökannan tutkimusaiheesta. Soittimet ovat kestäviä, mutta muuttamalla muutaman yksityiskohdan soitinten suunnittelussa soittimet voisivat olla käytännöllisempiä ja ergonomisempia. Soittimien äänen vahvistaminen ja äänen muokkaaminen tekevät soittimista soinnillisesti monipuolisia. Ajatus kehon jatkamisesta ja kehon vapautumisesta toteutuu soittaessa esiintyjän näkökulmasta ja dokumentaatiomateriaalien perusteella soittaminen muodostaa mielenkiintoisia visuaalisia kuvia soittajan ja soittimen välisestä suhteesta luoden samalla uusia äänellisiä ideoita ja soittotekniikoita. Soitinten kanssa esiintyminen on laajentanut kirjoittajan taitoja suunnitella performansseja sekä kartuttanut tietotaitoa siitä, että miten lavalla tehtävistä eleistä voi tehdä merkityksellisimpiä, ja miten etsiä kontaktia yleisöön.

Tutkimus pyrkii inspiroimaan ja antamaan tietoa taiteilijoille ja soitinrakentajille näkökulmasta, joka korostaa soittamisen kehollisuutta ja on samalla kriittinen epäergonomisuutta kohtaan. Projekti pyrkii lähettämään viestin – soitinten rakentaminen voidaan nähdä innovatiivisena taiteena ja merkittävänä työkaluna muusikoille esiintymistaitojen kehittämiseen.

Avainsanat kehon jatkaminen, soittimet, soitinrakennus, äänitaide, performanssitaide, ergonomia

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Master of Arts thesis abstract

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Abstract

Ihmiskehonjatkesoittimet is an artistic research on tangible instruments extending the human body. The starting point is to research if the intertwined relationship between a musician and a musical instrument could be emphasized by creating instruments that physically extend the body. The author's own experiences as a musician lead to discussion about the ergonomics of instruments, which is introduced in the theoretical framework of the thesis. As a context and inspiration for this thesis, instruments and artworks by other artists are being presented.

The research is based on reflection of the author during the process of designing and building the instruments, and practising and performing with them. Extensive documentation material of the process has been used as a tool for recalling the process and to illustrate the process for the reader.

Two main goals were set for the project by the author: (1) to build durable and innovative instruments that physically can be seen as body extensions and (2) to develop as a performing musician by viewing the new instruments from the perspective of performance art. The results of the thesis support these set goals. Each of the instruments has a different approach to them both from the viewpoint of building and strategies of playing – the instruments provide a diverse view on the topic. The instruments are durable, but some different choices in the design would have made the instruments more practical and ergonomic. The amplification of the instruments as well as the design of the sound manipulation makes the instruments sonically versatile. The concept of extending and freeing the body while playing is felt by the performer, and the documentation material suggests that performing with the instruments create interesting visual images of the musician-instrument relationship while creating new sonic ideas and playing techniques. Performing with these instruments has broadened the author's skills on planning a performance and being a performer – how to make the gestures on stage more meaningful and how to seek contact with the audience as a performer.

The thesis aims to give inspiration and knowledge to artists and instrument builders with the emphasis on embodiment and criticism on unergonomic music making. It sends a message that instrument building can be regarded as innovative art and meaningful tool for musicians to develop as performers.

Keywords body extension, musical instruments, instrument building, sound art, performance art, ergonomics

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Contents

1. Introduction

> "You've got to learn your instrument. Then you practice, practice, practice."
> – Charlie Parker

> "It's easy to play any musical instrument: all you have to do is touch the right key at the right time and the instrument will play itself."
> — Johann Sebastian Bach

Learning to play a musical instrument takes time like Parker describes above. Bach states the same, but with a bit of humour: playing an instrument is easy when you know what you are doing – and this means hours of practicing with the instrument. The quote by Bach is conveying also another idea than the "practice makes perfect", since he is articulating that the instrument would be playing itself after you know when and what to play. This is an interesting thought, as if the instrument would have an agency of its own. What I think Bach might have been meaning is that the body of the player will play the instrument by itself, even without conscious thinking. Many musicians explain that while performing, they are using the muscle memory of the body – in other words their bodies have the knowledge how to play a certain piece and the body starts to act automatically towards reaching the goal that it has practiced. I've experienced also myself some kind of merging of the body and the instrument and I've been wondering – does the instrument become part of my body for a moment? Singer-songwriter Tori Amos states even that her whole identity has been seen as the instrument:

> "I wasn't just an extension of the piano; I was the piano."
> – Tori Amos, interview by Powers, 1996

Unlike Amos's view, this research explores the topic of extending the body from the perspective of instrument building. I am a sound artist and with my thesis project I want to create instruments that I can perform with. During my studies at Aalto University I've grown interest towards building both

electronic instruments as well as physical sculptures. With this project I want to showcase my new skills as a designer and builder as well as to learn more about instrument building. My goal is to create innovative and durable instruments which would contain both physical sculptural elements and software-based electronic sound manipulation.

As mentioned earlier, the decision to research body extensions from the viewpoint of instrument building derives from curiosity towards the philosophical dilemma on what kind of unity a musician and a musical instrument is. I think that the body and the object become some kind of symbiotic hybrid and trying to build instruments that would emphasize that aspect also empirically interested me. As an artist in general, I enjoy working on relatable topics that I try to present from a new angle. Therefore, reshaping human body or showing a new possibility of using the body while playing an instrument was the starting point for this research. To contextualize my project, works by other artists and instrument builders are being introduced.

One angle to this thesis is ergonomics, because even though the relationship between an instrument and the player can be understood as symbiotic, it often seems that the human body is somehow being violated with physical pain. Enhancing the ergonomics in playing has been a current topic for some time already among musicians, and doctors or physiotherapists have nowadays more knowledge on this topic as well. The main problem I see, is that most of the musicians are maintaining their body in a certain position while being still, which is contradictory to what is thought about music in broader sense – music makes people move. Why doesn't the need to move then seem to apply to musicians themselves? I want to approach this problem by creating instruments that enable me to move freely while performing or practicing.

In my recent gigs as an experimental solo artist, I've gotten aware that being alone on stage feels very different compared to having an ensemble to play with. I've often performed behind a computer and a lot of gear, with limited contact to the audience. This seems to be a norm in the electronic music scene, and as a listener I would sometimes enjoy if electronic musicians would take more contact to the audience. With these thoughts on the background, I got interested in developing my performance skills towards being an active and hopefully charismatic performer, rather than a musician chained to one spot on the stage. Consequently, I set myself another goal for the project: to develop my performance skills. Embarking this goal from the perspective of performance art feels like a new and fascinating approach for me. I don't have a lot of prior knowledge on performance art, and for that reason performance artist Leena Kela is my advisor during the process of rehearsing with the instruments. The other advisor for the thesis is sound artist Marianne Decoster-Taivalkoski, who has been giving feedback on the sonic ideas as well as seeing over the whole process during a longer time period. I also attended Marianne's lessons in Sibelius Academy at the Centre for Music and Technology where we have had fruitful discussions about embodiment in music.

The thesis is an artistic research based on my reflection on the process. The theoretical framework consists of introducing related artistic works as well as opening up the key points on the discussion of musician's body with the angles of musician-instrument relationship and ergonomics. The research questions of the thesis are:

1. How are Ihmiskehonjatkesoittimet (in English Extended Human Body Instruments) instruments and performances designed and made?
2. What is my body doing while performing with Ihmiskehonjatkesoittimet?
3. How did practicing and performing with Ihmiskehonjatkesoittimet develop me as a sound artist?

The results of the thesis are divided into three large chapters, the first describing the creation process, the second the performances and the third the overall reflection on the project in dialogue the theoretical framework.

I claim that the research topic is current in many ways. In music research, embodiment has been a fashionable topic for almost twenty years now, for example musicology has been researching embodied music cognition and music education research has been delving into embodied learning. To highlight the present interest towards the body in music research, Oxford University Press has recently published "The Oxford Handbook of Music and the Body" (2018/2019) which includes various articles, for example from themes such as moving and performing body, the musical brain, embodied rhythm and music and the disabled body. Modifying human body with extensions also brings themes of post-humanism and cyborgism to discussion – the world is getting constantly more robotized and the question of how to improve our bodies with technology is very contemporary. Daily life phenomena, such as body awareness and do-it-yourself methods also resonate with this thesis topic. Traditional instrument building is thought to require a high expertise and the threshold of building instruments is quite high and even the experimental instrument building is not very common, at least in Finland. Experimental instruments are often played and developed by music enthusiasts rather than professional musicians. I hope that my research can encourage people to think experimental instruments also possible for professional music making.

While familiarizing with the subject of experimental instrument building and body extensions, I have come across a few projects that could be considered similar to mine. Most of the projects that have given me inspiration are art works and some of them are introduced in the second theoretical chapter (3.1 and 3.2). Finding other research with the same angle has been more difficult, some related topics are found. Music making through movements is a well-researched subject in media and sonic arts. In Aalto University there is even

a research group investigating sound and physical interaction (SOPI). Their artistic research projects explore experimental instruments that are using digital technology, for example using motion tracking both in an interactive dance performance where the dancers create music with their movements (Ahola, Tahiroğlu, Ahmaniemi, Belloni & Ranki 2011) and in a collective music performance where mobile phones act as musical instruments (Tahiroğlu, Correia & Espada 2013). SOPI's projects relate closely to a broader emerging field of New Interfaces for Musical Expression (NIME). NIME helds yearly an international conference on new musical interface design (Jensenius & Lyons 2017) where new electronic instruments are being presented. The projects working in the context of NIME are very fascinating, but they relate only vaguely to this particular topic. On one hand, a common factor is that NIME projects and Ihmiskehonjatkesoittimet are developed and used by individual artists or researchers, which makes the instruments to certain extent unique. But on the other hand, my approach was to build tangible instruments where the technology is transparent to the audience whereas the NIME projects often use digital technologies that might stay more obscure for the audience. Chapter 3.1.1 presents a few projects from NIME that I have found inspirational for my building project.

The skills taught in the Sound in New Media program offer great possibilities to work with digital technologies, and doing a master's project with the same topic could have very different results if the esthetic and philosophical standpoint would have been more rooted in media art. Instead, the decision to work with older technologies, for example without sensor technology, was done consciously: I wanted the extensions of the performer's body to be seen physically in order to emphasize visually the body-object relationship. With this decision, I also intend to make a clear connection to more traditional acoustic instruments and suggest that those instruments could also be seen as part of a human body. My assumption is that new instruments that are not tangible could be more easily seen as melding into the body of the player – the body seems to be more controlling the interface than the interface

controlling the human body. However, Tanaka & Donnarumma (2018, 79) conflict this thought by reminding of the advantages of acoustic instruments compared to embodied interaction in digital technologies – acoustic instruments create important corporeal coupling with the player whereas instruments without this physical benefit are not perhaps as capable of creating visceral feedback. With this thought in the background, it is therefore important to mention, that this thesis inspects the body extensions from both the corporeal angle of the performer, but also from the angle of the viewer, and therefore deeper research of the visceral nuances in the body are left out of this thesis. As conclusion, I believe that the body and acoustic instruments are often seen (perhaps not felt) as two separate things – and to contradict that assumption, I research this topic by creating physical instruments.

This written thesis is mostly based on the description of the project of Ihmiskehonjatkesoittimet – how I have designed and made the instruments, how I have performed with the instruments and how I have been developing as a performer during the project. I spent nine months generating the ideas and creating the instruments and then I performed with them in seven different events during three months period. The emphasis of the work is in the performances and the product of building these instruments, and therefore I wish that the evaluation of the thesis will be based 60 % on the artistic work that was done and 40 % on the written thesis. The evaluators are given video documentation to support the evaluation process. The written thesis contains also a lot of photographs to illustrate the process of creating as well as the finalized products.

2. Musician's body

In this chapter I first describe my understanding of my body through playing and singing. The other two subchapters are more theoretical. The second part elucidates on the relationship between musicians and musical instruments. The third part presents some key phenomena in music ergonomics in Finland. The whole chapter concentrates on examining the body through a physiological aspect, which I find to be an important viewpoint to this particular research on extending the body with instruments. There would be very interesting topics on musician's body also from a psychological perspective, but I've decided to leave that discussion out of this thesis.

2.1 My body as a musician

I identify myself as a multifaceted musician, but my instrumental education lies mostly on classical violin and pop/jazz-singing. I started playing violin when I was six years old. I remember how the movements of the upper limbs were difficult to control as a child – the left hand was rotated into an unnatural position and the right hand with the bow was even more strangely controlled. The bow hand has multiple different roles while playing: the bow should go straight down while extending the arm, the movement of the bow should be parallel to the bridge, the rotation of the bow towards the strings should be in 90 degrees angle or slightly tilting towards the scroll and the bow should keep its position in a narrow area between the bridge and fingerboard. Indisputably, violinists need to depend a lot on their proprioception, a mechanism of the body to determine the position and movement of body parts (Tanaka & Donnarumma 2018, 80.) A mirror is a good tool for observing, since it is difficult to see and feel the right movements. The inability to see oneself makes playing the violin tricky – as a violin student I got a lot of visual instructions on how the movement should be, but understanding the movement was difficult. I don't remember being

asked how the playing feels, it was always more about finding the right movements through looking and mimicking.

I began my singing studies at the age of 19, and it took me some time to get accustomed to the lessons. One big difference compared to instrumental lessons was that the teacher was asking me about how the exercises felt in my body. It took me a long time to get used to analyzing how my body feels – I realized that this was probably the first time in my life that I started to pay attention to how does something that I do affect the way my body feels. I had already noticed that playing violin for many hours resulted as shoulder and neck pain, but I had not gotten accustomed to analyzing my bodily sensations during the playing. Singing lessons taught me important awareness on my body and methods of analyzing how I feel in my body.

Violin playing leaves marks to the body – some are permanent, and some are temporary. The most common mark a violin leaves to the body is a skin irritation on the left part of neck, in the confluence of neck and jaw, caused by the contact of the chin rest and the skin. It is a mark that is commonly joked about because it looks like a love bite. As a child and teenager, I was very proud when I had played violin a lot and the mark appeared, we had even a small competition about it with my friends, who has the strongest mark. It is strange to think about it now, but the painful mark seemed to be some kind of measurement of the diligence of playing and therefore it was something that me and my violin playing friends were aiming for.

At some point I started to notice that there were also other, more permanent effects in my body that playing had caused. My left shoulder is always a bit higher than the right one, my head turns rigidly and there are some tension bumps deep in my upper back. I had also a more severe pain episode in spring 2017 when I was practicing rigorously for my violin exam, my both arms were in constant pain and while I was sleeping the arms were often numb. During that time, I sought for medical and physiotherapeutic advice.

To conclude, playing violin has huge ergonomic problems that I've felt as a violinist. On the other hand, playing has had also a lot of beneficial effects on my body, I have great fine motor skills in both of my hands and intensive rehearsing has developed my mind and body to be patient and relentless. It is of course difficult to prove if these negative and positive sides are solely a result of playing, but it is evident that the body shapes according to how the body and the muscles are being used. For me, starting singing lessons was an eye-opening experience that taught me a new kind of knowledge and awareness on my body. Nowadays I'm able to utilize those skills in my musicianship in bigger scale and thinking ergonomically while playing has become increasingly important for me.

2.2 The musician-instrument relationship

Instruments are vital tools for musicians. The relationship that musicians have with their instruments is often close and protective at an emotional level. To view the human-object relationship from the angle of this thesis, it is interesting to find out what kind of aspects are related to the relationship from the perspective of the human body. This chapter presents research on the body/instrument relation from various physiological viewpoints.

Leman (2007) describes that the human body is a natural mediator for music: a musician can utilize her body to transmit the musical ideas of the mind to be heard out loud. Mastering an instrument demands confluence of the player and the instrument, so that the performer can focus on the music, instead of thinking about the playing techniques. (Leman 2007.) Leman's thoughts seem to be influenced by Cartesian dualism where the body and the mind are separated, but the musician-instrument relationship seems to be more in synthesis. This is an interesting combination of thoughts and it suggests that the body and the instrument should merge together in order for the mind to be able to express the music interpretation.

Tanaka & Donnarumma (2018) continue in the similar thinking continuum about the body/instrument relation being compound, but they examine the body only from the physiological point of view. They explain that playing an instrument invites the human body into interaction with a sound-producing object – which engenders a corporeal interplay with the instrument, music, environment and situation. They propound that the interlocking of the human body with the instrument can be viewed as "a cybernetic human-machine extended system" (Tanaka & Donnarumma 2018, 79). This suggestion is related to McLuhan's thought on extension being a medium that affects the body, in this case sound being the medium (McLuhan 1964). This deduction about the instrument being an extension of a player is in great accordance with the research frame of this thesis. In this thesis though, the relation is articulated to be a human-instrument relationship instead of a human-machine relationship. The term of human-machine relationship works well in the research of Tanaka & Donnarumma who work a lot with digital musical instruments, but in my research on physical objects, the term instrument seems to be more suitable.

The research by Nijs, Lesaffre & Leman (2013) supports the above-mentioned ideas on the body and the instrument melding together while playing, and they use the term of embodiment in their philosophical and theoretical research. The results suggest that the feeling of uniting with the instrument happens when the interaction with the music becomes embodied – when the musician is bodily attuned towards the music. The musician's embodied experience consists of both perceiving the musical environment and coping with the challenges connected to the interaction with the environment. They describe the experience as follows:

> "It becomes an optimal embodied experience (*flow*) when the musician is completely immersed in the created musical reality (*presence*) and enjoys himself through the playfulness of the performance. -- Direct perception of the musical environment, skill-based playing and flow experience -- are only possible when the musical instrument disappears from consciousness while performing. The resulting transparency of the

> musical instrument leads to a short-term intuitive apprehension of being one with the musical instrument. The repeated embodied experience of being merged with the musical instrument leads to the musician's long-term intuitive apprehension that it has become a natural extension. The naturalness of the extension follows from the incorporation of the musical instrument into the body schema. The resulting attuning of the extended body to the musical environment enables the musician to freely and expressively communicate his artistic intentions on the basis of the corporeal articulation of the moving sonic forms." (Nijs, Lesaffre & Leman 2013, 9.)

The quote brings up again the notion of extension, which is crucial for this thesis. Nijs. et al are close to my own experiences on the extension being an intuitive apprehension of a player, but with this thesis the aim is to broaden that idea of extension to apply also visually to audience.

Iddon (2006) researched the relationship between instrumentalist and electronics. In this particular case, he analyzed a piece written for cellist and live electronics. He underlays the human-electronics relationship on Haraway's concepts of cyborg identity (Haraway 1991) and suggest that instead of the electronics and the instruments being each other opposites as the composer of the piece proposes, they construct "an integrated composite musical entity" (Iddon 2006, 94). Iddon's thought about electronics and instruments forming a musical entity, applies in my opinion to most of the pieces with live electronics. In this thesis, Ihmiskehonjatkesoittimet include electronics, which are embedded to the instruments already in the design. The viewpoint of electroacoustic compositions can be though different, since the electronics are planned on top of the acoustic sound. I would still argue that dividing the instrument and the electronics as opposites in an electroacoustic piece is old-fashioned, unless that the division has been exactly the base of the composition.

Simoens & Tervaniemi (2013) provide another kind of approach to the research on the relationship between musicians and their instruments. Their angle was to find out if the relationship with the instrument correlates to the

well-being of the musician. 320 musicians participated in a questionnaire carried out by the research team and the outcome was in accordance with the hypothesis: feeling togetherness with the instrument was regarded advantageous. (Simoens & Tervaniemi 2013.) Even though this psychological aspect is not in the focal point of this thesis, it is essential to point out that the togetherness in the musician/instrument relationship has also important psychological assets. The positive psychological side of feeling togetherness with the instrument applies in the reflection section of this thesis (see chapter 7.2) where I elaborate on what happens when playing an instrument which is not build ergonomically.

Lastly, Tanaka & Donnarumma state that even the human body itself can be considered as a musical instrument (Tanaka & Donnarumma 2018, 79). One key concept that this statement relies on, is the notion of body schemata. Body schemata is a term describing the human body as a wider essence with its incorporated habits, mechanisms, movements, feelings and attitudes (Shusterman 2012, 333). Therefore, the comprehension of the concept of (1) body schemata and (2) phenomenological embodiment supports the idea of the body either becoming an instrument or integrating with an instrument. Eventually though, seeing the body as an instrument depends on the level of technological intervention, aesthetics and cultural context. (Tanaka & Donnarumma 2018, 94–95.) This contextual reading is something that I should be aware of in this thesis project as well: making the instruments and presenting them as extensions of the body might not mean that other people would regard them in similar way.

2.3 Ergonomics with musicians

As the earlier described story of my musician's body proves, musicians suffer a lot from different kinds of strains connected to playing. Fortunately, ergonomics is nowadays much more discussed topic among musicians and there are different kind of methods to increase body awareness while playing.

Today there are also many options for musicians to get treatment by professional health care personnel in Finland.

Musician's strains are often caused by monotonous movements that are done repeatedly. To avoid these kind of repetitive strain injuries, it is important to pay attention to the ergonomics of the playing while practicing or performing. In instrument lessons, the instrument teacher should pay attention on finding ergonomic playing positions, but unfortunately the focus is often in the instrument and the music, not in the person playing the instrument. There are couple of body awareness methods that musicians have begun to utilize in their practice in order to find better ways to play their instruments. The Alexander Technique might be the most famous one. It is a technique that aims to improve the quality of the physical movements, and to lose tension and rigidness (Alexander Technique website). According to a violinist and the Alexander Technique teacher Paul Collins, the method provides various useful advantages for instrumentalists: it increases both the endurance, strength and coordination of the body, and the ability to stretch the fingers. Finding a balanced way to move the body also benefits the music itself by improving the tone quality and control of nervous tension in the player. (Collins.) Another technique used by musicians is Feldenkrais Method. The method aims that the musician discovers a better way to move by doing minimum effort and maximum efficiency. The method is practiced both in group movement lessons and hands-on sessions with a Feldenkrais practitioner. (Nelson 1989, 97.) These kinds of body awareness methods are useful for musicians, but unfortunately it seems that all the problems in the body can't be solved through playing more ergonomically – it is evident that the profession itself is challenging for the body.

The need for health care intended for musicians is clear. Nowadays there is a special field called music medicine that focuses on treating musicians. It is relatively new branch of expertise in Finland and a crucial step forward took place in 2000 when the association of Finnish Music Medicine was founded.

(Blum & Peltomaa 2002, 1608–1609.) The medical problems that musicians suffer from are mostly musculoskeletal disorders connected to the upper limbs but hearing and voice problems are also in common among musicians. The fast, unilateral and repetitive movements connected to static positions strain the tissues of the body. Young musicians need to push their body to extremes to attain the needed skills and older musicians are facing the same degenerative diseases as every human. Choosing the right sized instrument for each player can prevent many repetitive strain injuries. The most important challenge in music medicine is therefore to research and develop the ergonomics of playing. This includes an active discussion between instrumentalists, teachers, music doctors and instrument builders. The field of work of a music doctor is therefore wide: there needs to be an understanding of the anatomy and function of the body, knowledge on ergonomics and also understanding of the profession's mental side. Stress-related psychological challenges are common among musicians and therefore a holistic view of the conditions of the musicians' work is important. The health care of musicians is varying greatly among musicians, freelance musicians are often without occupational health care. Luckily many problems related to playing can be taken care of through general health care system, but sometimes a more specific music medical knowledge is needed. (Blum & Peltomaa 2002, 1610–1613; Lääkäriliitto 2004.)

There are some physiotherapists and masseurs specialized to treat musicians. A recent thesis explains that music physiotherapists must have an understanding on both musculoskeletal system and ergonomics of different musical instruments – but perhaps more interestingly, a deep understanding to the psychological side of the profession was found to be equally important. Often the physiotherapists will then further specialize their treatment towards different musicians, for example violinists, flutists or vocalists have their own specialists. (Söderlund 2018, 17–19.) For singers and wind players there are different treatment methods developed, in Finland Voice Massage and VoiceWell. Voice Massage method consists of both massaging the voice

production muscles as well as exercises on voicing and breathing (Laukkanen, Leppänen & Ilomäki 2009, 58; Voice Massage). VoiceWell is a newer method that also uses manipulation of the upper body muscles and also masticators and tongue are massaged inside the mouth. The method aims for general well-being and relaxation through the classical massage techniques – as well as increasing knowledge on voice production and awareness of the body. (VoiceWell; Grönroos 2010.)

From the point of view of ergonomics, there have been even dangerous ways of modifying the body to serve better the purpose of playing. During the 19th century there were some extreme methods used in order to change the physiology of the fingers to enhance the ability to play. For example pianists were clipping the skin between their fingers and others were using mechanical devices attached to the fingers. Sometimes the results of these experiences were bad, causing even inability to play. (Kuljuntausta 2006, 32.) Fortunately, today there is more knowledge on how the musician can develop their bodies in a healthy manner, so musicians are not relying on these kinds of absurd methods.

3. Extended body

The terms “extended body” or “body extension” are used in this thesis to describe something that has been added to the body and is visually seen. The objects can be for example attached to the body or surrounding the body. On a philosophical level, I would give all the instruments a possibility of being seen or felt as body extensions when played by professionals. Musicians spend most of their lives playing or thinking about playing: their bodies are shaped according to the playing positions and their minds keep rehearsing even though the instrument would not be at hand. Therefore, I would philosophically consider instruments as extensions of musicians’ bodies, because the musician and the instrument tend to melt together, as already stated in this thesis (chapter 2.2 The musician-instrument relationship). This idea is highly contextual, I would not regard a person trying an instrument for the first time as someone extending the body with an instrument.

Musicians often either hold their instrument or they go near the instrument which is standing. In order to examine the freedom in the body while playing, my project focuses on instruments that don’t need hands or other body parts actively holding the instrument. My hypothesis is that freeing the limbs while playing makes the body more relaxed and the movements freer. The first part of this chapter sheds light to wearable instruments.

The second part of the chapter introduces works extending the body by performance artists. The content includes both descriptions of physical and often sculptural extensions as well as more permanent alternations to the body – for example prosthetics that seem to attain an artistic value.

Some of the art works presented in the following two subchapters are close to each other, but they are categorized according to their use – is the extension made to be used in a musical context or as a performance tool in a more theatrical context.

3.1 Wearable instruments

This chapter presents wearable instruments which are divided to two subchapters according to both the use of materials in the instrument and the function of the instrument. The first section introduces conventional instruments and individual design-driven building projects made out of hard materials. The second chapter presents wearable instruments that are categorized as clothes – either because of the usage of soft materials, or the clear visual or functional reference to a piece of clothing.

3.1.1 Acoustic, electronic and sculptural instruments

As I mentioned in the introduction to this chapter – I think most of the musical instruments could be seen philosophically as extensions of professional musicians. When it comes to wearability of an instrument though, I would definitely draw the line to instruments that don't need to be held actively by the body while playing.

The most common way to avoid holding an instrument is to use straps for attaching the instrument to the body. Different kind of guitars, electric basses and accordions are often used with a strap as well as some woodwinds like saxophones, clarinets and bassoon. There are also some more rare strapped instruments, for example keytar and different kind of one-man band-instruments, which are often a collection of instruments strapped to the player. In the context of marching bands most of the instruments need to be portable so there is a vast selection of drums and percussions that are strapped to the player.

Sousaphone is a brass instrument deriving from the marching band tradition, but nowadays used in many genres of music. It was developed by American band leader John Philip Sousa in the late 19th century. Sousaphone and its predecessors, the ancient Roman cornu and buccina as well as the 18th

century French tuba curva are all brass instruments that are curved around the player. (Bierley 2006; Pagliaro 2016, 3–4; Encyclopaedia Britannica 2017.) The Belgian instrument-maker, the inventor of saxophone Adolphe Sax, made also his version of instrument surrounding the player called saxtuba during the first half of 19th century (Bevan 1990).

Most of the above-mentioned instruments are acoustic, but there are perhaps even more wearable instruments that are electronic and often experimental. These projects are often made by individual artists or by research groups or design studios. This thesis presents only a few projects electronic wearable instruments that were found to be inspirational.

From a historical perspective, The Hands (1984) invented by artist and composer Michel Waisvisz, is a famous electronic instrument extending the hands. The Hands is one of the pioneer digital musical instruments – it's the first portable MIDI controller. Waisvisz's vision was to use the new MIDI technology to build easily portable, affordable and playable instrument which he could operate with his hand, arm and finger movements. (Waisvisz 2006.) Technically, the instrument consisted of two gloves that were collecting data and converting it to MIDI. The first version of the instrument was made of two metal plates: the left-hand glove included 19 push keys, 4 mercury switches and ultrasonic receiver whereas the right-hand glove had 17 push keys, potentiometer, 4 mercury switches and an ultrasonic transmitter. The instrument was controlling remotely three Yamaha DX7 synthesizers that were programmed with special and responsive sounds. The second version in the 90s was a more ergonomic version of the instrument. This version had also more push keys, pressure sensors, clip cardioid microphone and a display board to enable the performer knowledge about activated functions of the instrument. The third version was ready in the year 2000 and the instrument was basically the same as the second version but with even more switches. (Torre, Andersen & Baldé 2016; STEIM.) The movement had also an implication and meaning for the whole body of the performer: he could be

moving and dancing while making electronic music. He felt that the ability to move while doing electronic music was important and "such a liberating prospect after having had to work with big chunks of unmovable analog electronica tied up in the early electronic music studio's" (Waisvisz 2006). This quote by Waisvisz was especially influential and inspirational for this thesis, because the aim was to make portable electroacoustic instruments that would make movement possible and even advisable.

Today, one ambassador of wearable sonic instruments is artist and researcher Di Mainstone. She creates sonic sculptures that are extending the body and transforming movement into sound via digital technology. Her works are playful, aesthetically interesting and technologically challenging – I present two inspirational works by her. The first one, Serendiptichord (2009) is a wearable instrument consisting of a headpiece with a trunk stretching over the shoulders and handheld pods. It is played with touch, physical manipulation and expressive movements – the artist describes the instrument as "a choreophonic prosthetic" (Di Mainstone 2019). The three-dimensional accelerometer-sensors are embedded in different parts of the instrument and they are reacting for example to shaking of the pods by manipulating sample sounds. (Murray-Browne, Mainstone, Bryan-Kinns & Plumbley 2010, 1–4.) Another instrument, the Human Harp (2014) transforms suspension bridges into giant harps. The instrument is amplifying the subsonic tones produced by the bridge's own cables with contact microphones. The player who is connected to the bridge through strings can manipulate that sound by changing the length and angle of the strings. Technically this is done for example by using rotary encoders and gyroscopes. The sound is heard through a loudspeaker located close to the player. (Human Harp 2019; Blum 2013.)

Di Mainstone is certainly not the only person exploring how to turn movement to music. Like mentioned in the Introduction of this thesis, the yearly conference of NIME (New Interfaces of Musical Expression) assembles

projects that work within this field: new digital instruments with embodied interaction. Prosthetic Instruments (2011–2013) by Hattwick, Malloch and Wanderley is an interesting example of this kind of work, and the core idea of this instrument suits well with this thesis topic. Prosthetic Instruments are a set of instruments designed for interactive dance performance. The instruments are called (1) the Visor, (2) the Ribs and (3) the Spine – and they are functioning as hypothetical new body parts. The instrument communicates wirelessly with XBee radio module to a computer which does additional sensor signal processing as well as mapping the data to sound synthesis. The sound synthesis takes place in CLEF (CIRMMT Live Electronic Framework), a Max-based modular environment for composition and live electronics. (Hattwick, Malloch & Wanderley 2014.) Similar projects are done by a few other artists, for example relatively young artist and art student Kate Reed has made beautiful sculptural projects called Musical Prosthetics (2018) and Body Accordion (2013). They both work straightforwardly with sensors which provide data to Arduino connected to Max which makes music from the given data. Musical Prosthetics-project has also an interesting aim to enhance non-verbal communication – each wearable sculpture portrays a different human emotion. (Reed 2016; Reed 2018.)

MONAD is a design studio that creates futuristic and sculptural digital instruments with 3D-printing technology. Their instrument SONIFICA (2016) is a good example of experimental wearable instrument done with high technological and design standards. The instrument aims to augment the performer's capacity to create spatial-sensorial compositions. The design process included analysing ergonomics by digital mapping of the playing postures and in this case the instrument has a specific player that it is designed for, musician Viktoria Modesta. Again, the instrument includes sensors, six-axis accelerometer and gyroscope tracking movement, force sensitive resistors (FRS) detecting physical pressure and actuators. The design contains protruding tusks in front of the player, where the musician

can control the sound with interactive buttons, sliders and FRS sensors. The sensory data is turned to music in Ableton through a connection with Arduino. (Goldemberg 2018; Goldemberg 2017.) From the perspective of design SONIFICA, is a well-embedded to the body of Modesta, using the 3D-printing technology makes the instrument look really as it would be growing to Modesta's body – it fits perfectly. Aesthetically, the hard materials and the white colour makes the instrument look futuristic but also a bit clinical. The tusks in front of the player resemble at the same time an animal who is ready to attack and an erected phallus – perhaps a strange combination of connotations for a musical instrument. Hence, it is important to understand that while performing with experimental sculptural instruments, there are all kinds of connotations that can be read from the visual design of the instrument. This is something that I find important to take into account while designing new instruments – and I'm sure that both MONAD studio has been aware while using sexual connotations in their instrument designs: it is a powerful tool to make audience curious.

3.1.2 Sounding clothes

Making sonic clothes is quite a rare area of clothing design, but when thinking about the field in broader context there are some examples of clothes that sound in cultural tradition. Most of the examples serve a function, often trying to accentuate the bodily movements with sound sources attached to the garment. As an example, belly dancers wear hip-scarves, belts and bra that are embroidered with e.g. beads, crystals and coins that produce sound when shaking the body. Different kind of anklets serve the same objective, for example Indian ghungroo-anklet contains either bells or coins (Rayner 2007), and similar ankle bells are also used in Finnish folk music. Coming slightly from a different tradition is the pragmatic example of the tap shoes. The metal plate in the bottom makes the shoe instrument-like, and the created sounds while dancing could even be interpret as a percussion solo.

From material perspective, different fabrics have their own sonic characteristics. Fashion design from the standpoint of the materials sonic qualities does not seem to be in common – this could be interesting new branch in fashion to experiment with. A current trend now is to make e-textiles, which are materials that conduct electricity. This gives compelling possibilities for designers to make clothing that could act as a controller surface for electric interfaces, for example sounding clothes. The end of this chapter gives examples of projects that share this idea of e-textiles, even though the technological point of view might be different. The beginning of this chapter introduces clothes whose design starting point has been focusing on art rather than functionality.

In an artistic context, contemporary artist Benoit Maubrey could be regarded as the pioneer when it comes to sounding clothes – he works with clothes that produce or carry sound. Maubrey and Die Audio Gruppe, a performance group found by Maubrey, make and use electroacoustic clothes as tools to enable the wearers interact with public spaces sonically. The performances are based on people wearing loudspeakers and moving in space. Maubrey sees the compositions as choreographed sounds where each "audio actor" or "phonic body" is part of the composition. The outfits sound according to their look – they reflect site-specifically environments, cultural traditions or social situations. Maubrey's most famous electroacoustic wearables are Audio Ballerinas (1989) and Audio Peacocks (2003). Audio Ballerina -outfit contains a plexiglass skirt which looks like a ballet dancers tutu and acts as a surface to mount different kinds of electronic components. The electronics in the tutu have been changing during the years, but he has been using contact microphones, radio receivers, mp3-players, digital samplers, movement sensors and light sensors controlling the pitch. The tutu is getting power wirelessly, nowadays with rechargeable batteries and in the 80s with solar cells. With the creative use of electronics, the costume can amplify sounds in real time, record, play and loop sounds, and effect the sounds with pitch-shift mechanism. (Maubrey 2011; Knotwe.)

Performance artist and musician Laurie Andersson uses her body in many ways in her performances and calls the body even "the ultimate portable instrument" (Anderson 1994, 217). Her electronic drum suit in the performance Home of the Brave (1986) contained sensors that she was controlling with wide and sweeping movements of the limbs. Researcher Silvija Jestrovic (2000) describes Anderson as human hybrid and a marionette body: "the drum sensors act as a kind of electronic puppet strings, dictating the kind of movements she must make – mechanical and puppet-like – in order to produce sounds". Jestrovic claims that Anderson's use of electronics and sound manipulation makes her body mechanical and her voice synthetic – almost suggesting that the performer is a machine. (Jestrovic 2000.)

Sound artist Laetitia Sonami is one of the pioneers in creating musical gloves. Her first Lady's Glove (1991) had five transducers and a magnet attached to kitchen gloves. She could vary the voltage levels with the magnet's movement and those changes in voltage levels were converted to MIDI signals that were sent to synthesizers and samplers. She describes the first version of the glove being "somewhat of a joke, a response to the heavy masculine apparel used in virtual reality systems" (Sonami). The next version had similar sensors with added microswitches that could be operated with one hand, so that the other hand was left free to control the mixing board. The third version of the glove had more sensors: bend sensors in fingers and wrist, a pressure pad for index finger and ultrasonic transmitter providing distance information between hands and the floor. The data was sent to analog-to-MIDI converter and then it was mapped onto Max-software to change the signal to sound. The following versions of the glove were merely changing the appearance of the glove, but also new electric components were added to the gloves: mercury switch and accelerometer to detect the speed of the motion, light sensors, some extra switches, LED light and miniature microphone. Sonami explains that her intention was to make an intuitively controlled flexible instrument that allows the performance flow fluidly. (Sonami; STEIM.)

Apart from sounding clothes in the niche of experimental sound performances, there is a field of wearable clothes designed for consumers. Especially there is a vast selection of products similar to Sonami's Lady's Glove – turning hands in to musical instruments. Most of the products utilise tracking of hand gestures as a tool for sound control.

MI.MU Gloves might be the most famous hand music controller initiated and developed by musician Imogen Heap. MI.MU gloves, abbreviated from me and my music, are packed with multiple features to track the body movements: the orientation sensors and finger flex sensors provide information on the movements of wrists, arms and fingers. The gloves have also buttons enabling to alter the orientation and turning effects on and off. MI.MU gloves are also taking into account the tactile and visual feedback: the design leaves the fingertips and palms open for instrument playing, and they give feedback through LED lights and vibration motors. The communication happens through MIDI or OSC messages with WiFi connection in two ways: the computer can send data messages to the glove and the glove can send messages to the computer. The sound processing happens then in a music software like Ableton Live, Logic Pro or Max. (MI.MU Gloves.) The product development required choosing the postures, finding the method of identifying them, and deciding the mapping strategies. The developers also strived for transparency in the mapping of gestures to music and they wanted to create an instrument that enables virtuosic playing and performative freedom. The gestures of the glove include effect controls like filtering, changing reverb and delay time, and controls of recording and playing, stopping and reversing. (Mitchell & Heap 2011.)

Most glove-related music instruments map gestures to music, but there are also other sensory ways to control music. Musiikkikäsine (in English music glove) is a Finnish invention developed in Jyväskylä University aimed to be a low-threshold musical instrument for everyone as well as interesting new tool for profession musicians. The research group refers to the idea of "a singing

hand" dating back to 11th century music theorist Guido of Arezzo who was using hand as a tool to learn solfege and music theory. The developers are also looking for educational applications for the glove and they see therapeutic possibilities in the use of it. The instrument has thin and flexible capacitive touch sensors which makes playing the instrument a tactile experience. The sound is output either through the glove or it can be plugged to headphones or external speakers. (Myllykoski, Tuuri, Viirret & Louhivuori 2015; Hämäläinen 2018; Savela 2015.) The articles and research papers don't shed light on the sound content of the glove but the CEO of the company that produces Musiikkikäsine, trumpetist Kalevi Louhivuori, is presenting the instrument in his YouTube-channel. In his videos he is showing the features of the glove, for example how the touch intensity is changing the velocity and filter of the notes and how the scales and sounds can be changed in the glove. However, Louhivuori doesn't reveal the electronic components used in the glove and the software he is using to produce the sounds, but it is apparent that the connection is operated via Bluetooth. (Louhivuori 2016–2017.)

Wearable and sounding clothes are garments or accessories that utilise audio technology in innovative ways. The technological approach is essential both in the artistic works mentioned by Maubrey, Andersson and Sonami as well as in the commercial music glove products. The example of the movement emphasising accessories like ankle bells and hip scarf are on the contrary not using any electronics – so this chapter presented a wide range of sounding clothes. As mentioned earlier, e-textiles are nowadays a big trend. Wearable technology is a fast-growing field and the development at the moment is quite agile. It is intriguing to see what the future developments wearable clothes contain.

3.2 Physical body extensions in performance art

In performance art the body is often in the center of attention. There is even a branch of performance art, body art, that addresses the body as the topic of the art – often with extreme acts done to the body. In this chapter, some works by performance artists are presented where the body gets a physical extension, usually a sculptural construction attached to the body. The selected works represents only a fraction of works that could be introduced. The chosen works in the following discussion have been influential for this particular thesis.

Artist Rebecca Horn is perhaps the pioneer of body extensions in performance art. Her performances and kinetic sculptures explore the relation between body and space. Her oeuvre consists of different kind of "body sculptures" as she calls them, where the body is extended for example with masks and hand extensions. The idea of the hand extensions is included in many works, such as Arm Extensions (1968) Finger Gloves (1972) and Scratching Both Walls at Once (1974–1975). Scratching Both Walls at Once is a piece that really expands the body to the space visually, each finger has an 1,7 meters long extension that is measured to reach the walls of the room where the performance takes place in. I find the impression of Horn in the room at the same time powerful and slightly desperate – even scary. Horn herself has described that she wants to draw attention to the need for human interaction with her body extensions, that are on purpose functionless and clumsy. (Rebecca Horn 2018; Le Feuvre 2016; Watling 2012; Tate.) I find the simplicity of Horn's works fascinating, the way they are done is comprehensible and that gave a lot of inspiration for this thesis: simple things can be powerful. I realized also that artworks without complex technological approach appeal to me aesthetically.

Stelarc is a well-known performance artist whose works deal with body. His performances often include sound and he has made a lot of works where he

amplifies his body. One of the earlier works of Stelarc is a mechanical arm extension called Third hand (1980) which then developed to Extended arm (2000). Both of these arm extensions include a system to amplify his bodily sounds. Stelarc moved from arm extensions to whole body extension creating Exoskeleton (1998), The Muscle Machine (2003) and StickMan (2017). These works are based on him being part of a big robotic machine. Exoskeleton is a huge 600 kg weighting machine which is mostly walking around in the venue of the performance. Stelarc explains that he is listening to the sounds of compressed air, clicking of switches and the legs hitting the ground and deciding the movements according to the sonic result he is aiming at. The sounds of the machine are being amplified and he has a possibility to bring more musical structure by looping sounds and creating more timbres by generating synthetized sound. The Muscle Machine is in many ways similar to Exoskeleton, but the data that is mapped to sound is coming from accelerometers. StickMan is expanding the use of sound since the performance is done with a multi-speaker setup where the sound is moving in the speakers according to the movements of the limbs. The limbs of the StickMan are amplified with contact microphones and data from accelerometers and gyroscopes is mapped into Max software. In this piece the sounds themselves become an extension of Stickman's body in the immersive surround sound setup. (Stelarc 2018.)

Artist Jana Sterbak explores also body in her artworks. A particular piece of hers, Remote Control II (1989) has significant resemblance to Stelarc's works which position the artist inside the artwork. Remote Control II is a cage-like skirt, a crinoline with wheels. As the name of the piece suggests, the structure is motorized, and other people are given the control over the movement of the metallic structure – meaning also that the person inside the crinoline is also being moved according to the wishes of the controller. (Nembhard 2017; MACBA 2007).

While searching for body extensions in music, I came across two musicians that call themselves with terms “the world’s first cyborg pop singer” (Fitzpatrick 2014) and “a bionic pop artist” (Viktoria Modesta 2017). The persons in question are already earlier in this thesis (chapter 3.1.1) mentioned Viktoria Modesta and Masami Orimo, and the decision to introduce them in this chapter is because of their musicianship is highly performative. Both of these artists are musicians that have a leg prosthesis – and the wish to make the prosthesis important part of their artist persona. Orimo is nowadays having a prosthesis with a violin string that she plays during her shows with a bow. Orimo describes that it sounds more like guitar or a synthesizer. (Fitzpatrick 2014.) Modesta’s prostheses are highly designed and modern – it is clear the she is looking for a polished and futuristic look. With the SONIFICA project (see chapter 3.1.1) Modesta is wearing a prosthesis that had accelerometer in it – so her prosthesis is also taking part of the sound manipulation. (Viktoria Modesta 2017; Goldemberg 2018.) Modesta’s and Orimo’s way of using their bodies to their advantage is of course special, they are disabled and like Orimo states: “Technology is a great enabler for the disabled” (Fitzpatrick 2014).

As a conclusion, the artworks introduced in this chapter give a scratch on the surface of extensions in performance art. What seems to be dominating the works, is the use of technology, only Rebecca Horn’s “body sculptures” rely on physical sculptures without the use of technology. I find her approach very charming and with I can find confluence with her early works and my thesis, if not in an ideological level, then at least in a technological level. Similar simple and transparent use of technology can be also found in Jana Sterbak’s Remote Control II-piece, a work I find also appealing because of its sense of humour.

4. Research methods

This thesis is an artistic research based on the reflection of the author about the process of designing, fabricating and performing with three new string instruments extending the body.

The research questions of this thesis are:

1. How are Ihmiskehonjatkesoittimet instruments and performances designed and made?
2. What is my body doing while performing with Ihmiskehonjatkesoittimet?
3. How did practicing and performing with Ihmiskehonjatkesoittimet develop me as a sound artist?

Suoranta, Vadén and Hannula (2014) sum up that artistic research is artistic process that is contextualized, interpreted and narrated. They suggest that the researcher is (1) being critical towards the conditions of the practice, (2) documenting the work, (3) changing the point of view from subjective to objective and (4) preparing works of art, but also state that "the ways of doing artistic research are genuinely open and should stay that way" (Suoranta et al. 2014, 15). In this thesis these mentioned aspects are taken into account and an emphasis is put on in particular to the preparation of works and on documentation. In an earlier state of the thesis work, a method of analyzing the documented material from more objective point of view was also considered, but the decision to focus on self-reflection was found to be valid and broad enough in this particular topic. The standpoint of the thesis is qualitative and the research could be regarded as a case-study, where the case is the author reflecting upon the experience of making and performing with Ihmiskehonjatkesoittimet. The qualitive research fits well with the project, since the artistic process happens through individual reflection in the

experience of a single person. (Hirsjärvi, Remes & Sajavaara 2007, 164; Eskola & Suoranta 2000, 19.)

The material of the study consists of the writer's own reflection upon the chosen research questions. In order to recall the thoughts on developing the instruments and performing with them, extensive documentation in the form of pictures, written notes, videos and recordings have been used. Especially the video documentation on the practices and performances proved to be useful while recalling what was done and felt during the process.

The video documentation of the work is large, the documentation of the rehearsals consists of 14 rehearsals with 55 shot video clips for approximately 447 minutes (7 hours 27 minutes) and the performance documentation consists of 6 performances with the overall duration of 175,5 minutes (2 hours and 55,5 minutes). One of the seven performances was not documented in video because of lack of time, but the performance is introduced in the thesis. The video material from the master concert has been edited also to be part of the appendix of this thesis to give more concrete example on how the instruments look and sound, and how was the author performing with them.

The vast video material could have been used to present more detailed analysis of gestures and movement in the work, but the aim of the research was to focus more on the process of the artist and therefore the detailed gestural analysis has been left out from this thesis. The analysis of the descriptive and self-reflective material has been therefore done thematically (Eskola & Suoranta 2000, 174–175, 178–180; Hirsjärvi et al. 2007, 219) according to each instrument in chapter 5 and according to each performance in chapter 6. The discussion to the theoretical framework happens in chapters 7.1 to 7.3. with each instrument considered separately and also a table of comparing results (chapter 7.4) gives an overview about the results of the study in pages 88 and 89.

5. Creating Ihmiskehonjatkesoittimet

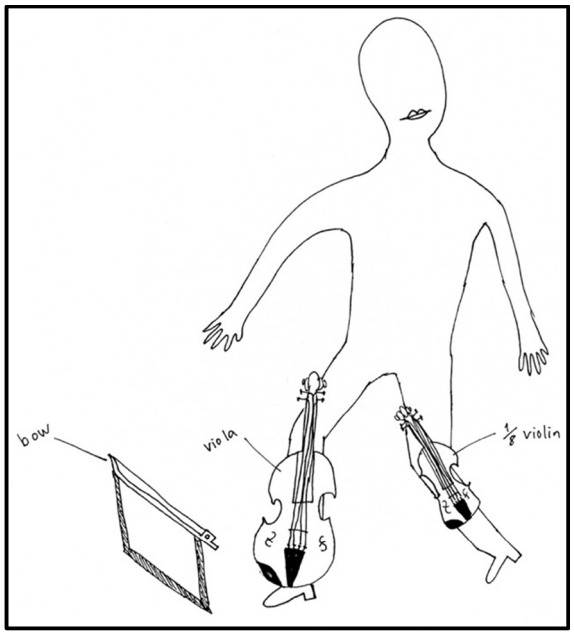
Developing Ihmiskehonjatkesoittimet was a process that involved a lot of thinking and also quite a lot of physical building. In this chapter, the process is divided into the physical designing of the instruments and to the design of the sound manipulation in a computer software Max.

5.1 Designing and building process of the physical instruments

The design process of the extended body instruments took a bit over half a year and then the fabricating took similar time. The idea was first to build just one instrument, but the topic sparked so many ideas that I decided to make three instruments. Each of these instruments have a different approach – Viuluvartalo is an old instrument presented in a new context, Kehäkitara is a completely new form of an electric guitar and Tölkit is an adaptation of a children's toy. The common thing in all of these instruments is that they are amplified string instruments.

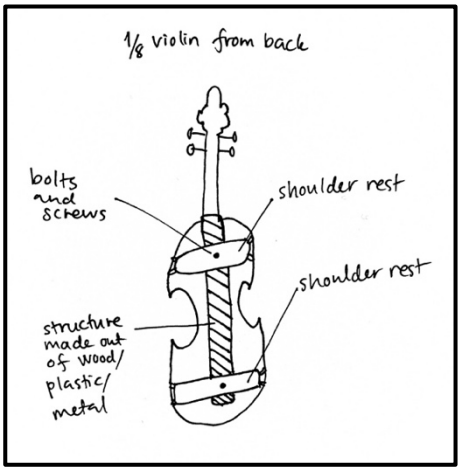
5.1.1 Viuluvartalo (in English Violin body)

Viuluvartalo represents ready-made aesthetics, taking an existing instrument and using it in an unusual way. The design process started with doing tests with a small-sized 1/8 violin and soon adding a cheap viola as the second instrument. The different sizes of the instruments made it possible to play around with the proportions of the instruments in relation to the body. The aim was to try to find ways to play violin, where the shoulder, neck and head area would be free and not fixed to tilt to the left side. The first drafts



and tests were about fixing the violin to the legs. It was possible attach the 1/8 violin to a leg, but the viola felt too big to fit securely.

Figuring out the method of how to attach the instruments to the body took time, violins are fragile instruments and avoiding any damage to the instruments was a priority. First, I was experimenting with tying the instrument to my body with strings, but it felt a bit insecure method and I was worried that a thin string could be rubbing the wooded surface to cause some damage. After lots of thinking, I decided to use shoulder rests that are already designed for the purpose of attaching violin. The plan was to fabricate a structure made out of some solid material and connect two shoulder rests to that structure with screws and bolts. In the end I did not even try make solid structure that would be screwed to the shoulder rests – instead I was using straps and belts for attaching the instruments to my body. It felt quite a secure solution and I liked the fact that I wasn't changing the shoulder rests by drilling holes to them. I thought that this would be a more sustainable solution, because the drilling could be difficult, and I might end up ruining a working shoulder rest – by keeping them in a good condition they could be used later also in their original function as shoulder rest for violin playing.



The final decision was to put both of the violins on the front side of the upper body. I tried also attaching the viola on the back side, because the shape of the instrument is somewhat similar to the shape of a human body (May Ray's photograph Le Violon d'Ingres is a famous example of this comparison). It felt uncomfortable to have the instrument on the back side – I had the feeling that the viola could fall any moment and therefore both instruments were put on the front side. I tried multiple versions of how the instruments would be placed, but from the start I was keen on having the viola as the lower instrument near my hips. Viola is quite a big instrument, so it was difficult to

fit it to the body on a vertical position, so horizontally near the hips was the best option. I had more experiments with the placement of the 1/8 violin, I was turning it to many directions and trying out how near it should be to the viola. In my experiments with moving with the instruments attached to me, I found it fun and interesting to isolate the chest area with the movements



from the hip area. Unfortunately, it was difficult to understand the size and position of the instruments and sometimes the oppositely directed movements made the instruments to clash on each other. I wanted to avoid this collision both to protect the instruments and to avoid a loud bang sound, so I decided to place the 1/8 violin near the breasts, far enough from the hip-positioned viola and necks in parallel direction.

Another thing that needed consideration was the amplification. A bridge microphone was placed to the viola and a contact microphone attached to the 1/8 violin. Contact microphones has sonically some inconveniences – the sound is lacking lower frequencies and the timbre tends to be a bit metallic. Using the contact microphone was therefore a questionable combination with the small-sized violin, which itself has quite a thin timbre, but then again it felt to be the best choice, affordable and still amplifying the weak sound of a small instrument. I made also a test with adding a third instrument to the body, my own and more expensive violin with a DPA-microphone attached to

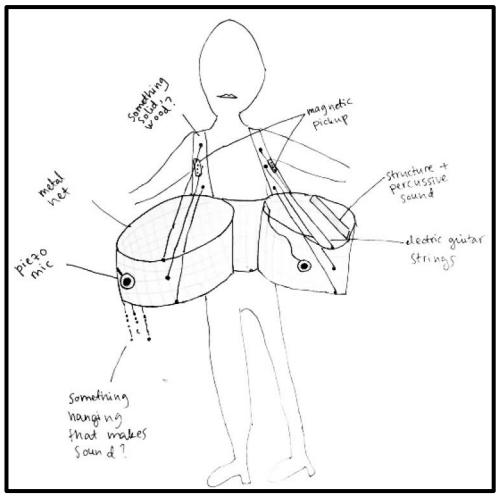
it, but it ended up stiffening my body and also making the amplification difficult, since there was even more of a chance of instruments accidently hitting each other and the 1/8 violin's contact microphone amplifying the sounds of clashing. The final choice was to have two instruments in parallel, necks to the same direction, bigger viola near the hips and 1/8 violin near the chest. This positioning enabled me to place the microphone cables to the same, right side of my body, which was convenient when moving around.

5.1.2 Kehäkitara (in English Surround guitar)

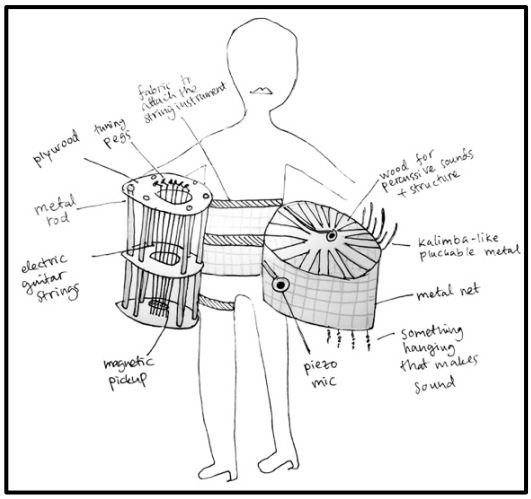
The design process of Kehäkitara was long and it all started by browsing through existing experimental instruments to find interesting ideas. As I am string player, the idea to make a string instrument was appealing from the start. I had been working earlier with balloons, so I made first some tests with long balloons. The balloons were for example attached to my shoelaces, where they could be stretched and plucked with hands. Adding up tension to the balloon would change the pitch. The flexibility of this instrument was great, but the instrument didn't feel really reliable: it could easily break and it wasn't very suitable for amplification. I also had set myself a goal to build something that would last and be of good quality, and this goal would not have been achieved through another balloon instrument.

In the beginning of the autumn 2018, I attended an instrument building workshop led by experimental instrument builder Yuri Landman where I used magnetic guitar pick-ups for the first time. I had been building and using contact microphones before, but I had not been always happy with the sonic qualities of contact microphones. The experience with magnetic pick-ups in the workshop was therefore eye-opening: it had richer frequency spectrum with also low frequencies, it was easy to use and cheap. I decided to build an

instrument with steel strings so that I can use magnetic pick-ups as the amplification method.

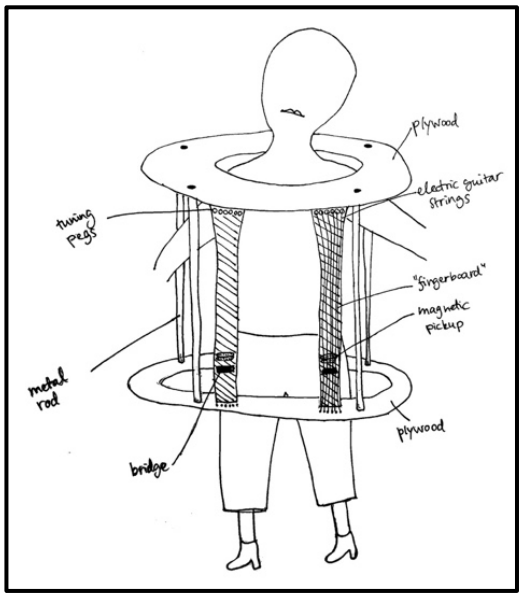


The first draft



The second draft

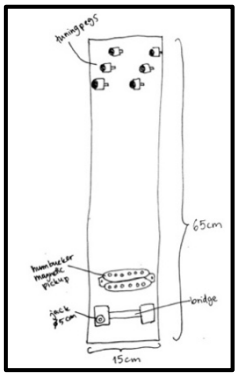
The first drafts looked quite a lot like "one-man band" solutions – a bunch of sound producing objects tied to the body. Since I did not have a lot of previous experience in building, the starting point was to think ways of building that I could execute. Building a structure from a metal net was convenient, it was easy material to work with, it could be shaped to interesting forms and when I was wearing it felt like a solid material. I was worried about how to get enough tension to the strings and I was also wanting to have some kind of acoustic amplification to the vibrations of the guitar string. For that reason, I started to make drafts with wooden structures and the experience from Landman's guitar building workshop was very useful. Somehow circular shapes where often present in my drawings, perhaps from the reason that in my first draft I had shaped the metal net as a circle.

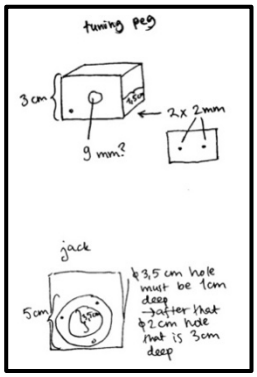


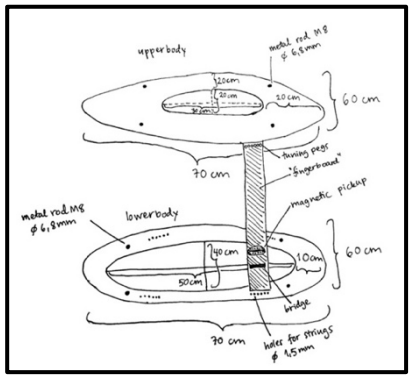
The third draft

I questioned if adding objects to the body would make the weight distribution of the instrument difficult and this led me to think of a bigger solid construction. What if I would have one instrument surrounding the body instead of a collection of smaller parts? At that point I was already quite sure to be using the laser cutter to cut the wooden parts of the instrument, so I started to make measurements on how big sheet of plywood fits to the laser cutting machine, will it be big enough for me to fit there too. I made detailed sketches of how the instrument could be build and there was a plan to make the first prototype of the instrument in December 2018. However, the workshop didn't have enough material for me to work on that day, so I decided to first make a prototype of the instrument in a smaller scale, based on the second draft of the instrument. Making a smaller-sized prototype was clever, I realized for example that I should redesign the placement of the strings – if the strings were coming through the bottom part of the instrument, it would be difficult to dismantle the instrument into parts. Another thing that I noticed was, that in the protype I used metal rods to form the structure of three layers, but it was difficult to place everything securely straight. These remarks made me change the way the necks would be made: I would make an instrument with four necks with the strings attached so that the necks could be disassembled from the upper and lower part of the instrument. As a reference of an existing instrument I was thinking of kantele – this would be an open string electric guitar. I chose to use angle iron with bolts to fasten the four necks to upper and lower body of the instrument.

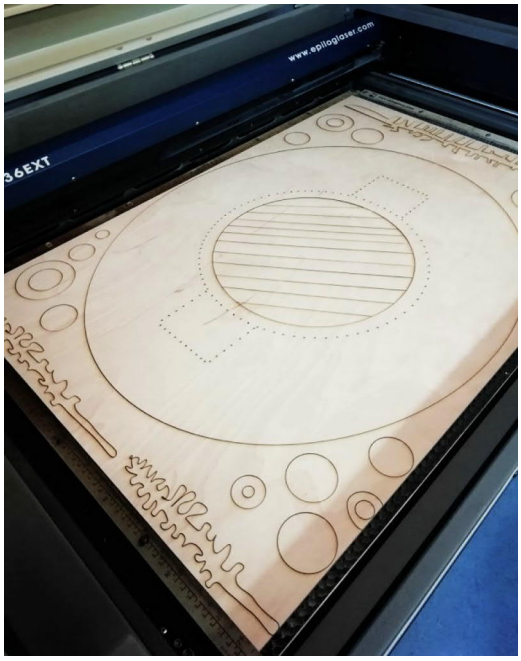
The prototype







Before starting the fabrication of Kehäkitara, I consulted luthier Timo Mustonen from the instrument building workshop of Sibelius Academy. He advised me to make a full size protype of the instrument from paper or cardboard, to see that are the measurements accurate – is it possible to fit to the instrument and get away from there. He pointed out that the weight of the four necks might make the plywood to bend over time, and to fix that problem he proposed to use two layers of plywood both in the upper and lower body part of the instrument. One option to realize this, would be to make in his words "a sandwich structure" by adding wooden bars in between the two plywood layers to stiffen the structure. Another thing that he suggested, was to plan a method to soften the edges of the instrument near the neck, so that the wood wouldn't scratch the skin. These advices were clever, and I implemented them to the design before starting the fabrication. I also took his advice to use spruce or alder as the material for the necks.

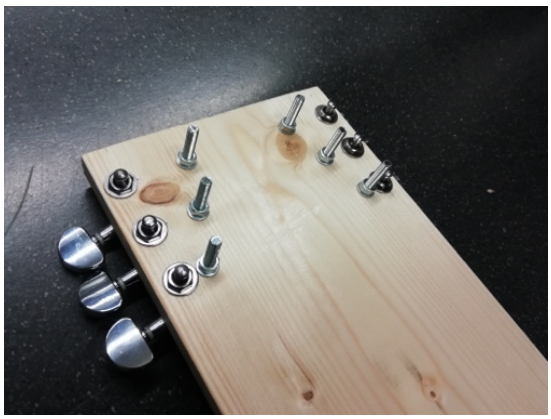


I used 6 mm plywood to cut the upper and lower body of the instrument. This process was relatively fast: first I designed the area to be cut in vector graphics and then I gave the laser cutter machine the AI-file for execution of the cutting. According to Timo's instructions, I fabricated two upper body parts and two lower body parts.

The construction of the Kehäkitara happened in the instrument building workshop of Sibelius-Academy, where I had the privilege to get consultation from instrument builders Timo Mustonen and Kirsi Vinkki. The process started with adding the angle irons to the plywood and then attaching the spruce necks to the irons. Finding the right spots for drilling the holes was sometimes challenging, because using a pillar type drilling machine was difficult because of the size and weight of the plywood whereas hand drilling machine would not necessary result in perpendicular hole. During the whole building process, drilling was the most prominent technique which was also used while making the holes for the tuning machines, mono jacks and volume potentiometer. The workflow consisted of first making one neck ready and then copying the same things to the other necks. The placement of the potentiometers was varying in order to be able to turn the necks on off while playing easily. Unfortunately, later I found out that I had made a significant design error since my hands could not reach the potentiometers while being inside the guitar.

After making the physical structure, it was time to assemble the electronic components. The wiring for the volume potentiometer and the humbucker pick-up was relatively easy. I went several times to consult the supplier of the electric guitar parts for my work, Uraltone, and the advice and help I got from there was varying from curiosity to disbelief – "you can't build a guitar like that". I was concerned about hearing the mains hum through the magnetic pickups, since I had that problem with both the instrument that I build in Landman's workshop as well as the small-sized protype of Kehäkitara. Basically, humbucker microphones should not pick-up the mains

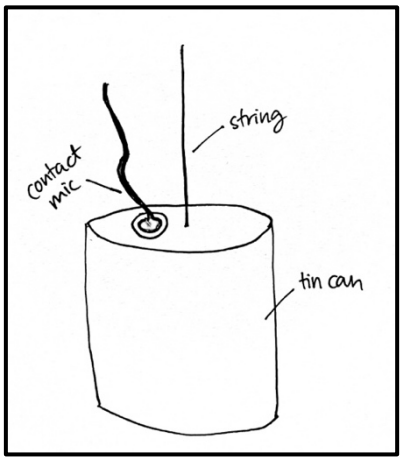
hum because of their two coil-structure which makes them to be out of phase to the electromagnetic field, which then again should cancel the electrical noise (Devers 2005). In this case though the design of the guitar was experimental and done intuitively – so from the point of view of electricity I made some errors. I should have made a Faraday Cage, a conductive shielding to the guitar to block the electromagnetic interference by inserting conductive tape, for example copper tape, to the cavities where the electronic components are placed (Artisan Luthiers 2019). In my design the problem is that the humbucker itself is not put to a cavity, instead it is lying on the surface of the neck. I was aware of this design error, but because of lack of time I didn't want to start carving the wood to make the cavity and shielding possible. In future developments of Kehäkitara, I would like to try to do the electric work a bit more diligently and see how that affects the sound of the instrument. While consulting both the guitar builders in Sibelius Academy's workshop and the personnel of Uraltone, I found the rules of electric guitar building surprisingly rigid. I was disturbed by people telling me that what I was doing was not possible, so my reaction was to act rebellious and see if I can use the humbuckers without being too orthodox. In the end I can conclude that the instrument surely works the way I build it, but I think doing the shielding would have made it more reliable instrument.



The surface finishing to the wood was done with a wood wax colored “Light Oak” which made the spruce necks and the plywood to have the same warm tone. The last part of the fabrication was to soften the edges of the neck hole. This was done with foam rubber placed under a brown leather cover. Stitching the leather was surprisingly hard, it was difficult to cut the leather to fit exactly the hole and to spread the leather evenly to the hole. The final result is satisfactory, but since I have previous experience on sewing, I thought that this part of the fabrication would have been easier and the result more precise.

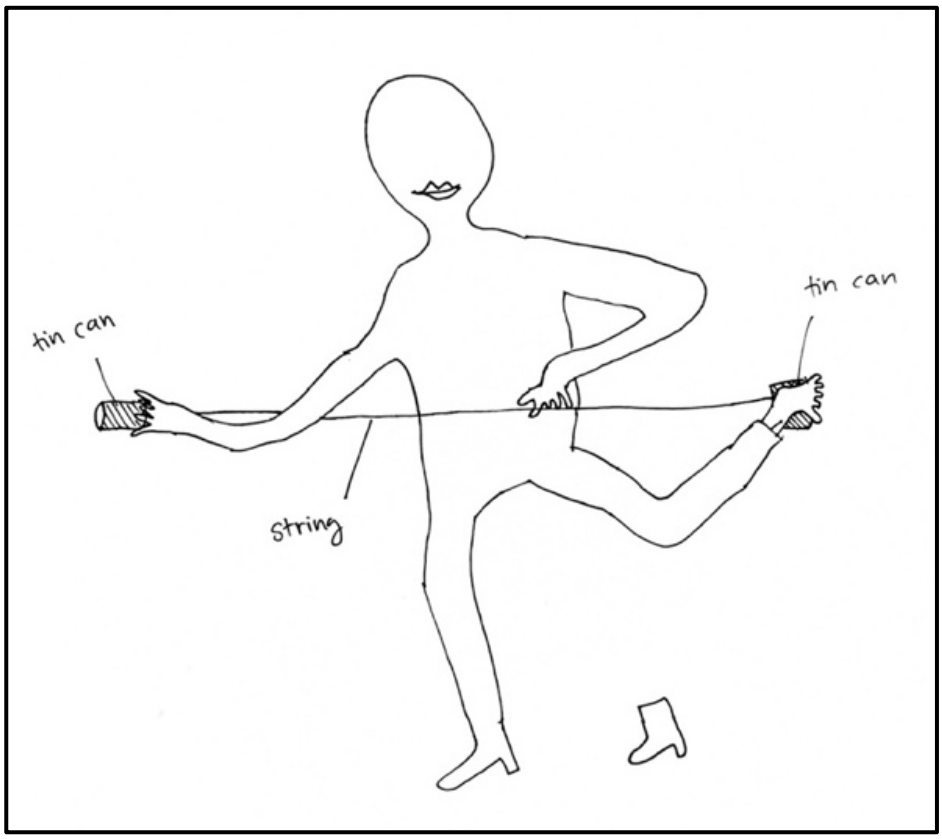
5.1.3 Tölkit (in English Cans)

The design of Tölkit is exactly like a tin can telephone with added contact microphone. The concept of tin can telephone dates back to 17th century to natural philosopher Robert Hooke, who made acoustical experiments by sending sound waves through wire. Similar principles were used in inventions in the 19th century, Charles Wheatstone found out that by connecting sounding-boards of two musical instruments through a thin rod the sound could be transmitted – knowledge that later on proved to be useful while developing the telegraph. A few decades later from Wheatstone, Lemuel Mellett invented The Pulsion Telephone, a mechanical phone that was used in the railways to transmit sound even for the range of 4,8 km. (Grigornis 2008.) Nowadays tin can telephone is used as a tool to demonstrate sound vibrations. Building a tin can telephone is fast, cheap and easy, and therefore it is a common self-made toy.



As described above, tin can telephones are often used to transmit voice from one can to another. My inspiration for the instrument came from the idea of trying out how far I could transmit singing. Since my thesis project was set to research sonic ways to extend the human body, I was curious to transfer the human voice to a far distance and do perhaps an ensemble piece were the singers would be singing physically far away from each other and the audience. I had been working earlier with the idea of transmitting solo voice spatially by recording my voice to a software looper and diffusing it to multiple speakers. The next chapter (5.2 Designing the process of the sound manipulation in Max) sheds light on this project since the patch was also used in my master project. However, with the tin can instrument, I was excited about exploring spatial sound from physical point of view were everything would be transparent, understandable and perhaps even relatable

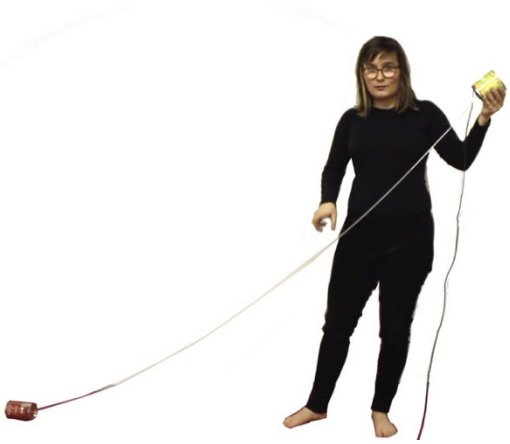
to the vocalists and the audience. Therefore, from the beginning I was thinking a lot about the venue of the concert and I got keen on the idea of performing a spatial vocal piece in a church, were the singers would be transmitting the voice from the balcony of the church to down to the benches to the audience.



The reality was that I was trying out the instrument in smaller places and alone – which forced me to use rather short string between the two metallic cans. I quickly realized that the can instrument functioned well also as a string instrument. Because of the simplicity of the instrument, there were many ways to pluck the string and body was being very active while playing. The principle of the instrument was to stretch the string and then pluck it and in order to get the tension of the string high enough, the cans needed to be far apart from each other. My wish was to leave the instrument untied to keep the instrument free and flexible for many variations of playing. I tried many versions with the length of the string and ended up using a length that would approximately be the measurement from my hand to my foot. My

thesis advisor Leena Kela made an interesting remark on this decision: I had made an instrument that would measure the proportions of the body. This meant also that the instrument enabled exploring how far the limbs can reach. I found that to be a fun starting point to explore the instrument – to try to understand my body's proportions and at the same time try to stretch the limbs far away. I realized quickly that unconventional body postures worked well with the instrument when the length of the string was suitable. My rehearsals with the instrument were lively: fun and physically challenging.

The fabrication of the instrument included also building the contact microphones for the instrument. This time I needed to make the audio cables rather long to be able to move with them freely. I used blu tack to attach the microphones to the cans. The principle was that I was holding in my hand the can that had the contact microphone on it and then stretching the other can further away. This way I felt I had more control and therefore the chance of dropping the contact microphone was small.





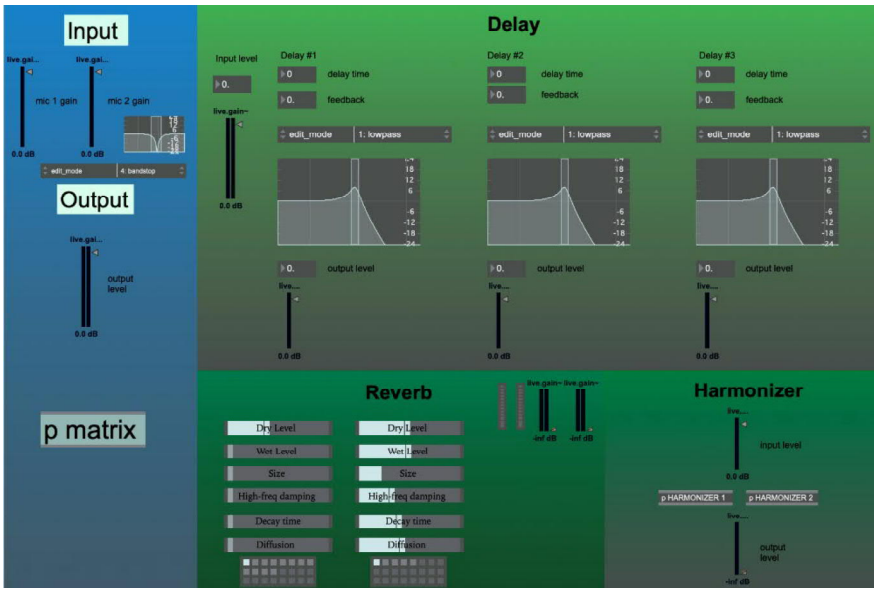



5.2 Designing process of the sound manipulation in Max

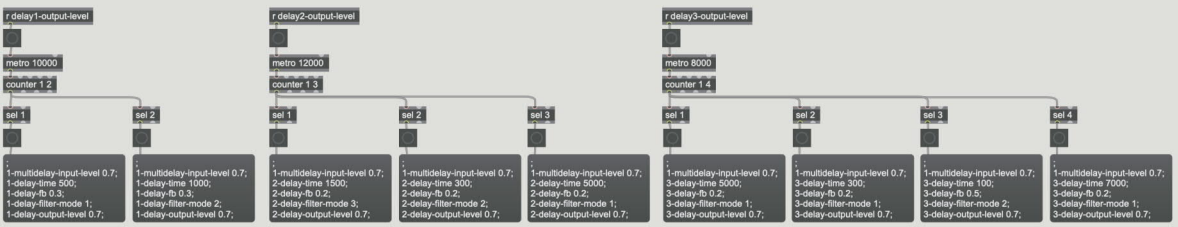
All the three new instruments were designed to be amplified. The reason for amplification was to make sure that all the instruments were heard and also that the sound of the amplified instruments could be manipulated while performing with them. I chose Max – a software using a visual programming language, as the software for sound manipulation, because it is fairly reliable program in live situations, and I had already some previous knowledge on working with it. I also wanted to deepen my skills with programming with it – using it in my master project felt like a motivating platform for practicing how to use the program.

I decided to make individual Max patches for each instrument. The foundation of each patch was similar: the patches included different kind of modules manipulating the sound either controlled by the computer or by me. The patches were developing during the seven performances I did with the instruments in spring 2019 and in this chapter I will explain how the patches that I was using in the master concert worked.

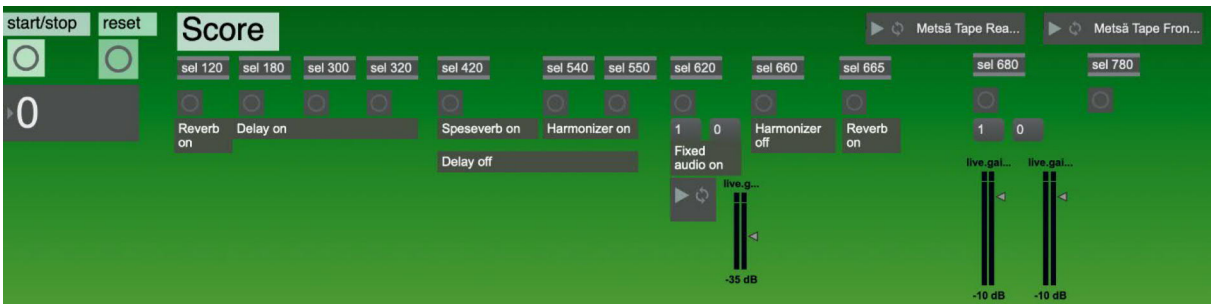
Viuluvartalo- and Tölkit-patches were both basically similar, including sound manipulation through reverb, delay and harmonizer. The reverb was a basic reverb including presets that would change the room size, dry/wet level,



decay time, diffusion and high-frequency damping. I wanted the reverb to grow within time, so I learned I needed to have two separate reverbs whose audio outputs I would cross-fade to make smooth transitions from a reverb to another. The delay included three tap-delays whose parameters were changing in time. For example, the delay time and filter of each tap-delay was changed in an individual speed and rhythm, varying from 8 to 12 seconds intervals of 2 to 4 different options. The aim was to create a vivid delayed sound. The harmonizer was working in a similar manner – changing the pitch according to interval of seconds in two different harmonizers.



The triggering of these effects was controlled by the clock of the computer. I had composed a linear effect score that I would start before the performance and then the computer would play the score according to the seconds. The score included putting the effects on or off and also playing fixed audio tracks. I decided to make a score that would be run by the computer itself because I wanted to give myself a possibility to focus on performing by playing, not by triggering effects. I also liked the idea that the sound manipulations would be seen as self-evolving, perhaps magical to the audience. If I would have had a clear triggering for example through a midi pedal, some part of the audience would have understood that now something is happening or going to happen. Unfortunately though, the way I built the clock was not reliable enough and

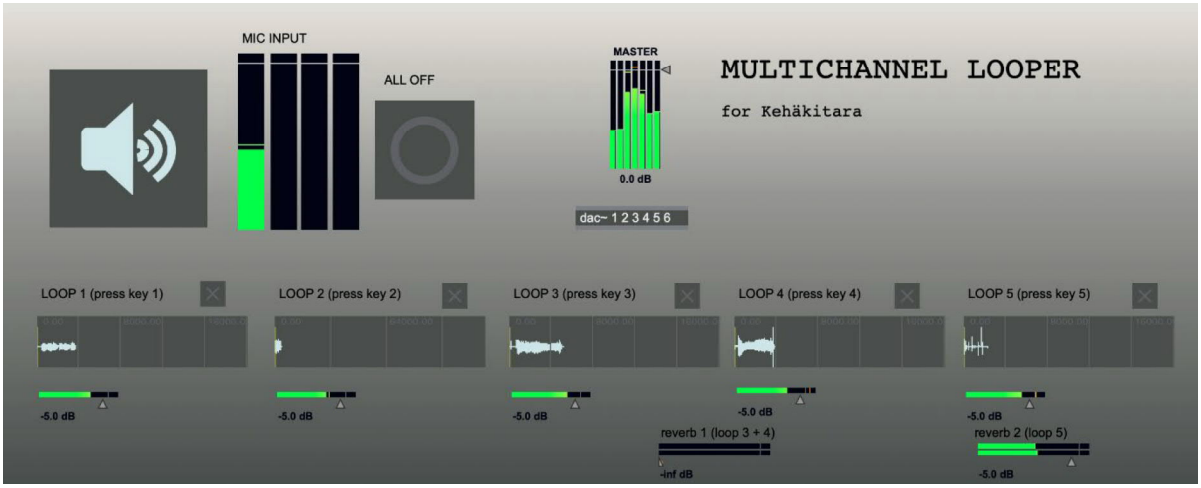


for that reason I had couple of performances that the seconds were for some reason longer than they should be, which made the whole performance to last longer than planned. This would be of course be a huge problem in a through-composed piece, but since Viuluvartalo and Tölkit were based on improvisation with some preplanning, I was able to adapt to the slowness of the sound manipulation. In a way it created an interesting playing moment with the computer where I as a human had to wait and listen to the computer.

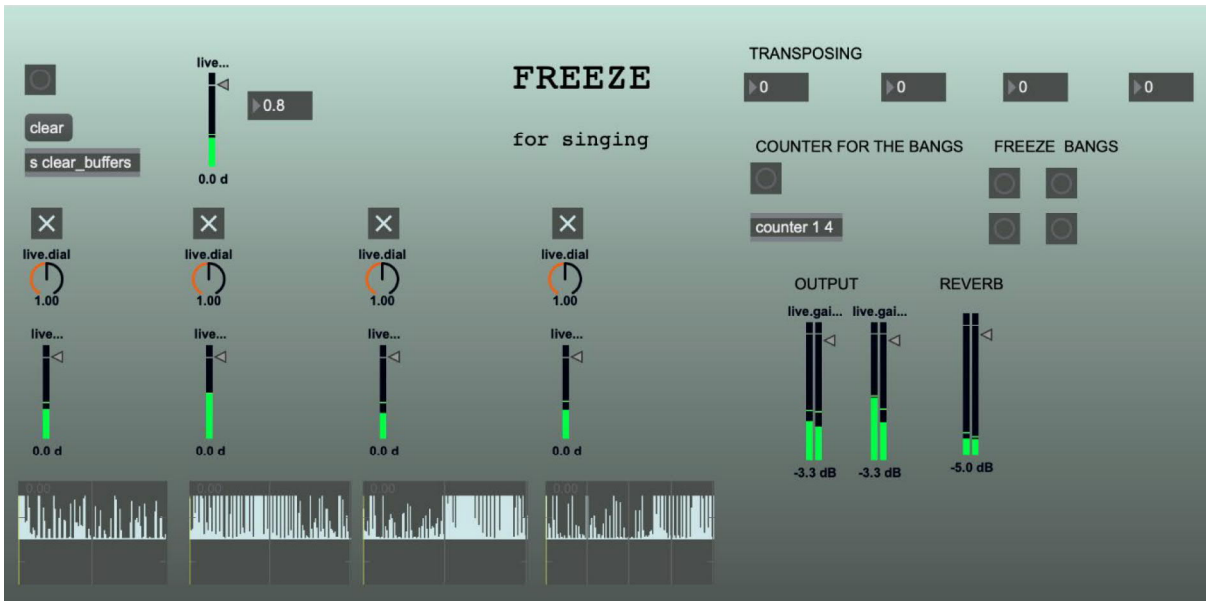
The design of Kehäkitara-patch was significantly different than the other two patches. I decided to use a midi foot controller to trigger a looper and a freeze-effect. Both looping and freezing a sound include recording audio signal and therefore using an external controller was needed. The ability to loop the sound of the guitar and freeze the voice gave me flexibility during the performance to build rich sound with layers. This was good since the rehearsal period with Kehäkitara was short – preplanning and practicing before was more challenging than with the other two instruments.

I had earlier during my studies in Aalto University, build a multichannel looper that I used to record voice that would be diffused to 7 speakers. Most loopers are based on recording sounds on top of each other to create layers and to form songs. The multichannel looper I designed was based on five individual players that could have each different length determined by a triggered starting and ending point. After recording the samples, the patch would start to manipulate the sounds for example by altering the speed and direction of the sound. The speed would change the frequency and length of the sample and the direction would manipulate the sound to be sometimes reversed. On top of those manipulations, the patch would also diffuse the sound to different speakers with predetermined routes and speeds. The result sounded interestingly fresh every time even though the patch was repeating the same alterations in each individual player.

This patch was easy to redesign so that I could use it with Kehäkitara. I mainly needed to change the triggering method of recording, in the earlier version it was done with the keypad of computer, but with Kehäkitara I changed the triggering to be done with an external MIDI footswitch. Using basically the same patch was of course convenient, but I found also the multichannel looper to be conceptually very suitable with Kehäkitara. While playing the guitar, I'm literally surrounded by the sound of it and I wanted to recreate this feeling to the audience members as well: they are surrounded by the amplification of the instrument.



Another feature that I decided to have in the patch was a possibility to sing and freeze my voice. This choice was made from a very practical point of view,



I wanted to add another element to make the sound world rich and exciting – and I had just built a freeze effect during the Max course I was attending in Sibelius Academy. This patch I could quite easily just to add to the Kehäkitara patch, again I just needed to find a way to trigger the sounds with the external MIDI controller.

To summarize the design process in Max, it is evident that I was learning from others and implementing that to my usage. All of these patches were either developed under guidance of teachers of Aalto University and Sibelius Academy or learned from the internet. My competence in using Max is still in its early days, and my approach towards learning to use the program has been to understand the principles and learning through copying from others to get some pleasing and concrete results fast. I would like to get a wider understanding of the program, and hopefully at some point be able to start to make actual inventions with the program. The patches that I was using in my master project are all working, but for the future I would like to expand the possibilities of sound manipulations within Ihmiskehonjatkesoittimet. This is something that I can slowly start to explore – and perhaps that will change even quite drastically the way I will perform with the instruments.

6. Performances

This chapter gives an overview about seven performances I did with Ihmiskehonjatkesoittimet in spring 2019. My original intention was to make one big master's concert with the instruments, but since I got many opportunities to perform before my own concert, I decided take advantages of those possibilities to perform and test how I could play gigs with these new instruments. The multiple performances provide a comprehensive empiric material for the research. I regard the performances before and after the master concert as innovation moments and rehearsals with Ihmiskehonjatkesoittimet whereas the master concert itself and the finalized versions of the instruments as the final product of my thesis project.

Each subchapter contains a reflective text about the performance. The reflections are based on my description and analysis of how I felt during the performance and what I see in the documentary videos. I've included also some feedback from the audience as well as some thoughts that I've shared in my tutoring sessions with my thesis instructors.

6.1 Ääniaalto IV festival: Viuluvartalo and Tölkit

General information:
Friday 22.3.2019 at 19:40
Ääniaalto IV Festival,
Vapaan taiteen tila Helsinki
Performance duration: 16 minutes

This was the first performance with Ihmiskehonjatkesoittimet. I had been practicing for some weeks before the gig – trying out different ways of playing and also constructing a structure for the performance. The structure was important tool for me to both time the events and also to ensure that both the visual and sonic material was versatile and interesting. The musical content was always improvised in the rehearsals, but when I found something that worked well that idea became part of the performance.

During the rehearsing period with Viuluvartalo, I found it most logical to start the by plucking the string (pizzicato). I started usually from small and conventional plucking gestures and then went towards bigger and more unusual movements with the hands and the body. Gradually I would start to also use different kind of objects: first one bow, then taking another bow and eventually playing the violins with two extra hands. I came across these two hands, a wooden hand and plastic toy hand, and I thought it was interesting to use them as objects to excite the strings. They were giving an absurd visual connotation – sometimes it felt like the extra hand was extending the body to be three handed. Also, sonically the result sounded fresh, the hard materials of the objects could be heard, the instrument sounded different when played with the different materials.

I decided to take off the violins approximately halfway of the performance, so that I could perform with Tölkit freely. I had also tested to play Tölkit while having the violins attached to my body, but since the violins felt restricting my ability move, I wanted to take them off. With Tölkit I didn't have such a clear structure of what I will be doing and in what order. In my rehearsals I had found some tools that I wanted to use during the performance. One method I was using was to find contrasting ways of exciting the string, for example using different body parts or using different gestures such as plucking or pulling. Another method was to try to stretch my limbs as far as I could, and then find a way to make a sound. The third method I found during my tests, was that I could use the metallic can as a microphone for singing. The sound manipulation on the Max patch I built was working especially well while singing to the can – for example the delays and reverbs made very nice atmospheric effect to the voice.

The performance was based on the concept of growing, the gestures getting bigger and musically moving from less notes in slow tempo towards accelerating more complex musical patterns. Like mentioned in the chapter 5.2., I had decided the sound manipulation to have an arc of growing from

more usual effects to more experimental ones. Since I had to take off the violins during my performance, I made a prerecorded audio track that was played while I was changing the instrument. It was more comfortable to have sound than silence while taking off the violins.

I was mostly happy with how the performance went. The only thing that I was unsatisfied with was that in the last 5 minutes of the performance I felt a bit uncomfortable and confused. I think that this unsure feeling was because I hadn't practiced the last part of the performance so well and I felt the sound was on the brink of feedback most of the time, which made me uneased.

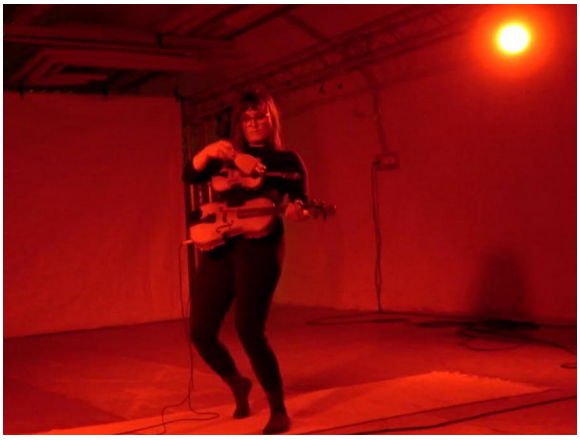
I had first planned that the performance would be just with Viuluvartalo, but I decided to change the performance just few days before the gig by adding Tölkit and taking off the violins during the performance. Because of this last-minute change, I practiced the later part of the performance for the first time in the morning of the performance day. I realized that this lack of time with rehearsing the new part could be seen during the performance. Even when rehearsing, it wasn't completely clear for me what was the aim of the section with Tölkit – I had not figured out in detail what I want to do musically. Therefore, I went to perform with an open mind of improvising and create the sonic content in the moment.

I had decided just two goals: trying to stretch my limbs to interesting positions and to play around with plucking the string and singing to the can. Now when I think of it these two goals could have been clearer for me: what are those interesting positions, what are the different ways to excite the string and what is the point of the singing in the can – what I aim to express through that. The second thing that made performing the last part difficult was that I couldn't keep my balance in the way I was hoping for. I tried couple of times to stretch my legs in different ways, but I was having hard time to keep the balance. I had already fell in the sound check and I got again worried about falling, and therefore I decided to not try too difficult positions

to avoid some loud accidental sound resulting from uncontrolled body movement. The next day I had also muscle pain in my feet and buttocks, so I think one reason for my bad balance was that my muscles were tired after the morning rehearsal and the soundcheck. Another reason could be that I had been practicing near a wall, but in the performance I didn't have any wall nearby the stage that I could lean against if necessary.

What I was very happy with the performance that I actually got new ideas during the performance. One idea came during the violin pizzicato, when I was dropping my hand and playing around with gravity. Dropping the hand low made me also try to reach further up with my hands. This created more dimensions to my movement and the end result was far from traditional playing gestures. The movement reminded me of an experimental dance movement, but one could find also other kind of interpretations for the gesture. While watching the documentary video, my thesis instructor Marianne mentioned that the movement looks like some gesture of wizardry – as if I would be "casting a spell on something". It was very intriguing to see the gestures by watching the documentary video of the performance, I was surprised how some of my playing gestures could be perceived as images or references to something non-musical. This is something I had not internalized earlier even in bigger context of being a musician on stage, that my body and my movements might make a visual reference to something that I had not intended. I found this realization exciting.

Another thing that was interesting for me during the performance connects widely to my realization mentioned above – I noticed that I started to make a narrative while performing. In my tutoring lessons with Marianne and Leena, we had already talked about my relationship with playing violin and



how through these performances I was trying to figure out new ways to play the instrument with more free body and at the same time building a new relationship with violin. During the performance, I noticed myself performing a story where I was going from conventional posture and more composed playing towards softer and more unpredictable body and playing. Playing around with this narrative during the performance was very liberating because I felt I found a goal to what I was doing. I didn't need to come up with something clever and interesting – these two extremities, calm and conventional versus free and unpredictable with my own story as a violinist gave me a reason to freely do what I was willing to explore within this framework.

After the performance, I talked with people and it was interesting to see how the things I had felt uncomfortable about were actually the things that the audience had been most interested about. For example, someone had felt that my shaky legs and unbalance was the thing that "made the performance raw and honest" – that I felt really "like a human being". Someone else thought

that when I was singing in the can and I was worried about the feedback that the being on the edge of feedback is beautiful and they thought that sounded the best in my performance. People were also commenting that I should sing more because of "my beautiful singing voice". It is very intriguing to take into account this scope how it feels to perform and how it feels to watch a performance. As a musician I aim at the same time for quality and relatability – and apparently the things that I might be unsure about myself might be the ones that others find interesting.

6.2 Kuulolla acousmatic club: Viuluvartalo and Tölkit

General information:
6.3.2019 at 19:00
Kuulolla acousmatic club,
Laterna Magica art gallery & bookstore Helsinki
Performance duration: 20 minutes

The structure of this performance was very similar to the previous performance in Ääniaalto IV festival. The only change I had made was that the prerecorded track I was using in this performance while taking off the violins was different. In my tutoring session with Marianne, she questioned the sounds I was using in the first performance – she found the sounds to be a bit too hectic and out of context. I agreed with her comments and decided to change the sounds to be closer to this particular performance: in the first performance I had used some violin and viola recordings from another project, but in this performance I recorded more calm pizzicato sounds that were similar to the ones that I would be performaning with. This decision made also a nice arc to the performance: it started from simple pizzicatos, grew bigger and in the end of Viuluvartalo went back the sounds from the beginning. This enabled a small thinking pause for the audience before starting the second part of the performance with Tölkit.

The venue of this performance was difficult because the space for performing was very limited. The space where I could perform was around 1,5 m x 3 m rectangular area where I could just move sideways. Also, the concert series I was part of was based on acousmatic music, which means music that is played through speakers. To emphasis the idea of acousmatic music the concert organizer had decided to make the audience and the performers visually separated with a curtain in between. I was aware that the venue would be small and the audience wouldn't see me – the setup was certainly difficult for doing a visual performance, but I set up myself a goal to try to make a very physical performance, maybe the use of my body would be heard even though I wouldn't be seen.

Even though I had set up myself a goal to make a physical performance, I quickly noticed that it was challenging in this particular venue. During the performance I ran into many obstacles that hindered my aim to perform physically. First of all, because of lack of time in the soundcheck I wasn't able to really test how the space works before I started performing. I noticed a big mistake in setting up my gear: in Viuluvartalo all the cables are attached to the right side of my body, but my gear was on the left side. This made the cables to be on my way and the cables were often tangling up with my feet when I tried to move. The performance area was also very dark, and I think the ability to balance for example when standing with just one foot is quite much based on seeing the space – a bit more light could have made it easier to perform. Otherwise I think my balance was better in this performance than in the earlier one: I had made sure that I didn't tire my muscles before the performance and I had also mentally prepared that in a performance situation in new venue I might not be able to do all the things that I was able to do in my rehearsals.

Another reason that made performing difficult was the setup of the sound system in the space. Because of the acousmatic theme of the concert, the speakers were set to the other side of the curtain, and probably due to the

small budget of the event, there was unfortunately not a sound engineer to mix the performances. This meant that I was in charge of both performing and the levels of the sounds at the same time. Having these multiple roles during a performance is anyway challenging, but the placement of the speakers was making it especially hard, even impossible. Because I couldn't really hear what the audience was hearing, I had to be careful with the levels of the audio, and that took away my ability to perform freely and focuse on being physical. I also had a problem with a contact microphone which fell once when I had attached it to the can. These kinds of loud sudden sounds are very uncomfortable for the listeners, since it creates a distrust towards the performer – can the performer play with comfortable sound level or will this performance damage my hearing? I'm particularly careful with this myself, so when a mistake like this happens during the performance I take it seriously.

What I was surprised about during the performance was the sense of time. In my previous concert and in my rehearsals playing for 20 minutes had been feeling like a long time and I was doubting that can I make something interesting for the whole duration. In this performance I felt that I almost ran out of time. I think this different feeling about time is connected to the presence of audience. In this particular gig, the fact that I wasn't seeing the audience made me perhaps a bit more relaxed, I felt less like someone is viewing or reviewing me. I liked the feeling of being behind the curtain, just heard not seen. Another point that confuses the sense of time could be about the different mindset between performance and rehearsal. While I'm performing I need to be confident and have a poker-face – I am using performing skills while I'm performing and not while I'm practicing. In a performance situation I need to feel more like I know what I am doing or at least I have to pretend that I know what I am doing. In my rehearsals I am more aware of what I'm doing, I'm thinking more technically about what I am doing, how is this sounding and is this interesting. I think the feeling during a performance can reach the so-called feeling of flow – you get excited about

the performance and you trust your mind and body to do the things you've rehearsed before. And in flow you often also loose the sense of time.

Pictures of the performance, pictures are edited by adding light.

6.3 What ever works festival: Viuluvartalo

General information:
6.4.2019 at 19:00
What ever works-festival,
Manilla / Vanha viinatehdas Turku
Performance duration: 11 minutes

This performance was structured quite similarly as the two performances before with Viuluvartalo. I had couple of new methods that I was using during the performance: I was starting the performance with lying down on my back and I was also using a new object to play the violin with.

Overall, I was the most comfortable and happy with this performance so far. This was the first performance that I was focusing performing with only one instrument, Viuluvartalo. The length of the performance was also shorter than the previous performances had been. I think both the length of the

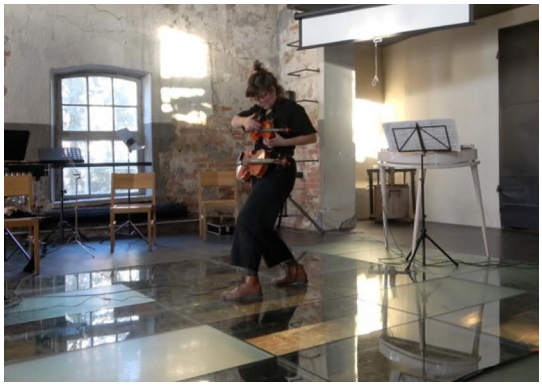
performance and focusing on one instrument made the arc of the performance better – I had quite a clear plan of what I was doing.

Even though I felt I knew what I was going to do I was trying two completely new things in my performance. I had had a meeting with my thesis advisor Leena the day before the performance and she gave me a task to do something completely new for the next day's performance. I decided to start the performance by lying down on my back on the stage and then slowly standing up. I hadn't rehearsed that if it's possible to play in that position, but the position felt surprisingly free – I was really enjoying playing the violin while lying on my back. This playing position is actually quite impossible with normal violin playing so it felt exciting to find something completely new. Lying on the back made me also to find new kinds of movement, I was moving my whole body by sliding in the floor. I think this kind of unusual movement was interesting and I believe it created new kind of connotations – being active while having movement that looks even a bit lazy. Lying on the back made me look towards the ceiling which was interesting for me as a performer – I rarely gaze up while performing. In the earlier Viuluvartalo performances, I had been standing and looking down to the violins so that my eyes were not seen. Hence, I wasn't very accustomed to the audience seeing my eyes, and now when reflecting on the performance, I feel I could have thought more about how I was looking up. On the other hand, my gazing freely towards up was me being feeling honestly bodily free and relaxed – this feeling of some unintentionality in the performance might be also relatable and fresh to the audience.

Another thing that I was trying for the first time in this performance was to play the violins with branches of pussy willow. This particular plant has an interesting contrast of soft furry catkins and harder wood, which made the sonic quality also interesting. The choice of the plant was to play around with this contrast and also contextualize the performance with the season. The pussy willow is a plant that is connected to Easter and I wanted to try to see

what kind of images I can create by connecting a plant that has a lot of connotations to unusual musical and performative context. I had not tried at all before the performance how to play with the branches. The new tool created some innovations during the performance: I was hitting the strings with the branches and also started a circular movement with the branches. The act felt all in all exploratory and fun, even a bit strange. This tool had more material feel to it than the bows or wooden hand and the material was changing during the performance as some parts of the branch fell to the floor. I found this idea of change intriguing – my actions change the material I'm working with. This change of material could also be a reference to the more traditional violin playing, when the pressure of the bow hairs gets hard, the violinists need to remove the cut hairs from the bow. In my opinion, these broken bow hairs act as a nice manifestation of the physicality of playing an instrument, because they show concretely how the actions of the player have a consequence.

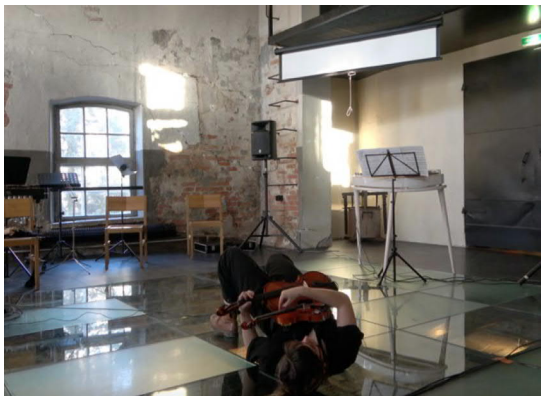
The venue was good for the performance. The only problem I realized later on was that the audience was situated to two separate places in the space and I should have used the space better and remember to perform equally to both directions. I had noticed the audience being on both sides, but during the performance I forgot to pay attention to both audiences equally. This is something I want to be more aware of in the future performances.

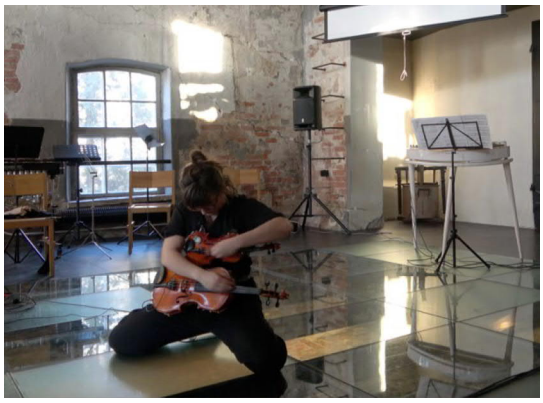


There was an unfortunate feedback problem in the beginning of the performance. I waited for a while lying on my back in the stage for the sound

engineer to fix the problem, but as it wasn't fixed, I had to stop the performance and then start again. Even though this occurrence was uncomfortable, I was happy that I decided to stop the performance and was able to continue in a calm mindset.

I don't remember receiving any feedback from the audience, but the concert organizer described me to be "the Jimmy Page of modern music", which I found a funny remark. Overall the atmosphere of the concert was warm, and it was interesting to be performing in a formal concert setting, the other pieces were more traditional classical contemporary music.





6.4 Braided Sound collaborative improvisation: Viuluvartalo and voice

General information:
24.4.2019 at 19:00
Braided Sound collaborative improvisation and
duo improvisation with Petri Kuljuntausta,
Akusmata Helsinki
Performance duration:
duo improvisation 7,5 minutes and Braided Sound improvisation 49 minutes

The setting of these performances was very different since this happened with other people and not as a solo performance. I had not met the people I was playing with before, so all the interaction was spontaneous. This made it difficult to analyze the structure of the performance since everything was

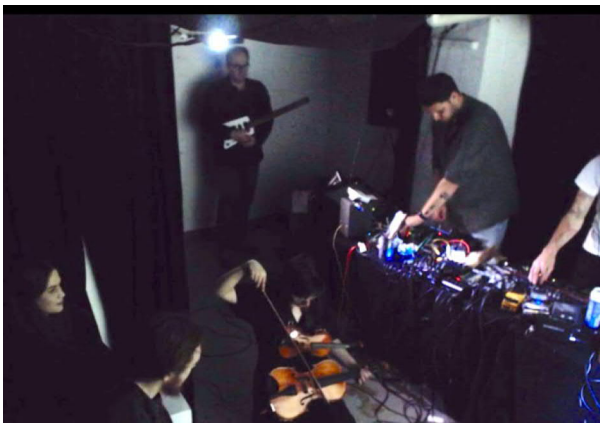
decided in the moment. Both of these performances were based on sound improvisation and my focus was also more on the auditory result than the physical performance.

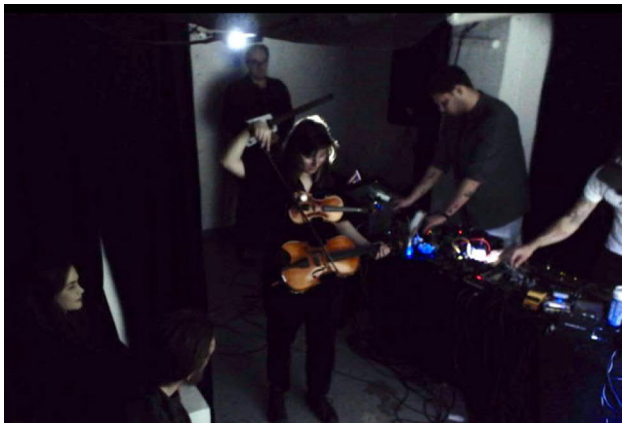
The concert started with me and sound artist Petri Kuljuntausta playing a duo set which was based on aural improvisation completely. The only thing we decided before was to keep it rather short approximately in 5 minutes duration. Petri was playing samples from his computer and electric guitar whereas I was wearing Viuluvartalo and effecting the sounds of the violin and viola again with Max. Sonically our sounds merged together very nicely. Playing with Petri was all in all a pleasant experience, we had our ears open and reacting well to each other's playing. From angle of performative sound art, this performance was definitely more of sonic piece or a gig – my performance was based on sounds and bodily I was not taking risks, I looked like a violinist who plays violins in a non-traditional way.

The second part of the performance happened as a collaborative improvisation with a bigger ensemble consisting of me, Petri Kuljuntausta, Marloes van Son, Alex van Giersbergen, Jeremy Young and Jesse Perlstein. The improvisation was based on a graphical score where each of us players were following one drawn line. The score and the concept of the performance is initiated by Perlstein and the performance was a part of his international collaboration project called Braided Sound. We discussed a bit before the performance how the structure of the performance will be and I made one decision before the performance: during my solo I would go front and make some bodily gestures.

While playing with others, especially with a large ensemble – I felt it was sometimes difficult to find a space in the improvisation. My approach before with Viuluvartalo had been to focus on the use of space and gestures, but with both the context of the performance being improvised ensemble and also restrictions of the space made me to change my behavior. Akusmata is a

small space, so fitting six musicians with their gear there is problematic. I was playing most of the time behind a corner in a very limited space.





Afterwards, while listening to the recording of the gig, I feel quite controversy to my thoughts about "not finding my space in the ensemble" – I think I'm too much in forefront with my playing. There might be several reasons to that: I was not seen by most of the audience so maybe I felt that I need to find my space by playing a lot. Another reason could be that all the other instruments were electronic, and my violins were amplified acoustic instruments. From the point of view of timbre, my sound was very different from the other sound sources. Since we hadn't played together before, during the whole performance we were also figuring out what kind of sounds the other players make and how can we fit to that texture of sounds with our own playing. All in all, it was interesting to do Viuluvartalo in ensemble context and I learned new things about the instrument: it fits to be part of a group, but it is difficult to use it as performatively as in solo performances.

6.5 Ihmiskehonjatkesoittimet -master's concert: Viuluvartalo, Kehäkitara and Tölkit

General information:
7.5.2019 at 19:00
Ihmiskehonjatkesoittimet -master concert,
Kallio Stage Helsinki
Performance duration: 42 minutes

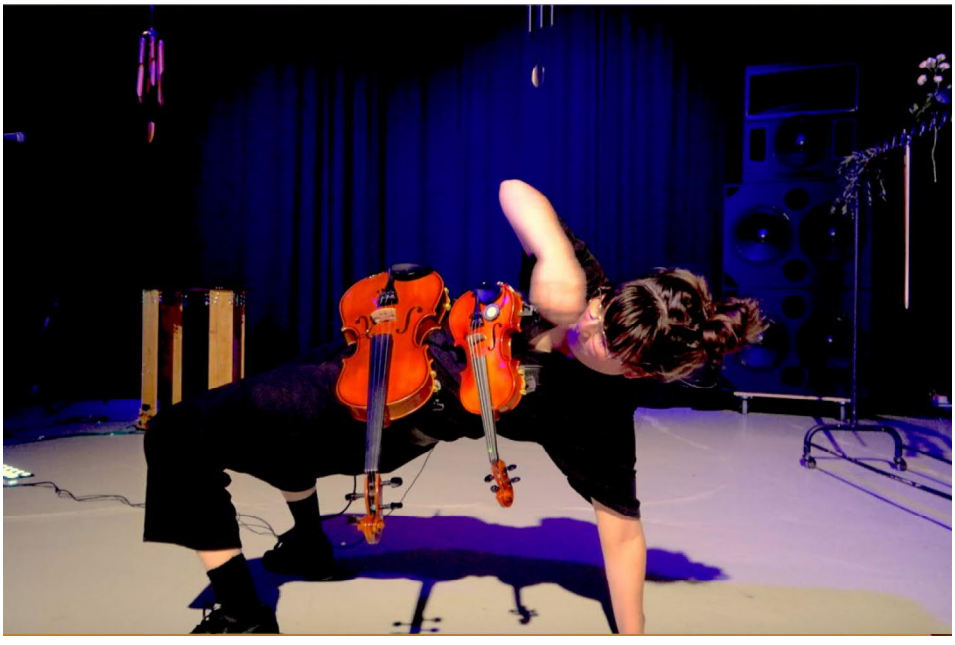
Ihmiskehonjatkesoittimet master concert was the final goal of my master thesis performances. The concert was also the first performance where I was performing with all the instruments: Viuluvartalo, Kehäkitara and Tölkit.

The venue, Kallio Stage was 12 x 8 meters stage, so I had plenty of space to move. I placed objects that I would use for exciting the strings of the violins to different parts of the space. I had a coat rack on the right side of the stage where I put the bows and some flowers hanging. On the other side of the stage was a podium with dried flowers and a wooden hand. From the ceiling there was hanging two large wind chimes: one wooden one and one metallic one.

The performance started with Viuluvartalo and I was following similar structure as in the performance in What ever works -festival. I started the performance lying down while playing pizzicato. I got gradually up, and the effects of reverb and delay started appearing. While being on my feet I was trying to remember to move in the space and change the position of my face and torso, so that both right and left part of the audience would see me well during the performance. The placements of the objects made it natural for me to move in the space and to change the way of playing the instruments. I hadn't decided which of the objects I will use during the performance and what would be the exact order of using the objects, so I tried to keep an open mind during the performance about the structure.

I had decided before how the sound manipulation in the Max patch will be – and that was actually the only thing that caused me some problems during the performance. I had planned that the whole Viuluvartalo part of the concert will last approximately 13 minutes, but for some reason the clock in Max software was going somehow slow and I ended up performing with the violins for 20 minutes. I had moments during the performance when I was really waiting for a certain sound manipulation to start already, and in the moment I was thinking that maybe the time just feels to go slower during the performance. The slower schedule of things made me to come up with more ideas in the fly, which was nice, but then again I felt that I would have liked to develop some ideas for longer time if I would have known that the events are going on slower speed. This is something that I was slightly

uncomfortable about and definitely a technical thing that I would like to solve in the future, so that the performance would flow more smoothly.



I made a transition from Viuluvartalo to Kehäkitara through a four-channel audio track consisting of forest sounds. I needed time to take the violins away from my body and go inside the electric guitar. During this transition I put also long plastic flowers to my head to extend my height. The lights of the space were gradually turned to green colours from more typical warm concert lighting.

I made a conscious decision to change my way of performing – during Viuluvartalo I was focusing a lot to my hands and I did not seek a lot of contact with the audience. My idea was that as soon as I enter Kehäkitara then I change my focus to be really towards the audience by seeking direct eye contact and being a bit more playful with my gestures and movements. This decision was partly based on the fact that while I'm inside Kehäkitara I don't see my hands, but even more importantly I wanted to test how I feel as a performer when looking more directly to the audience.

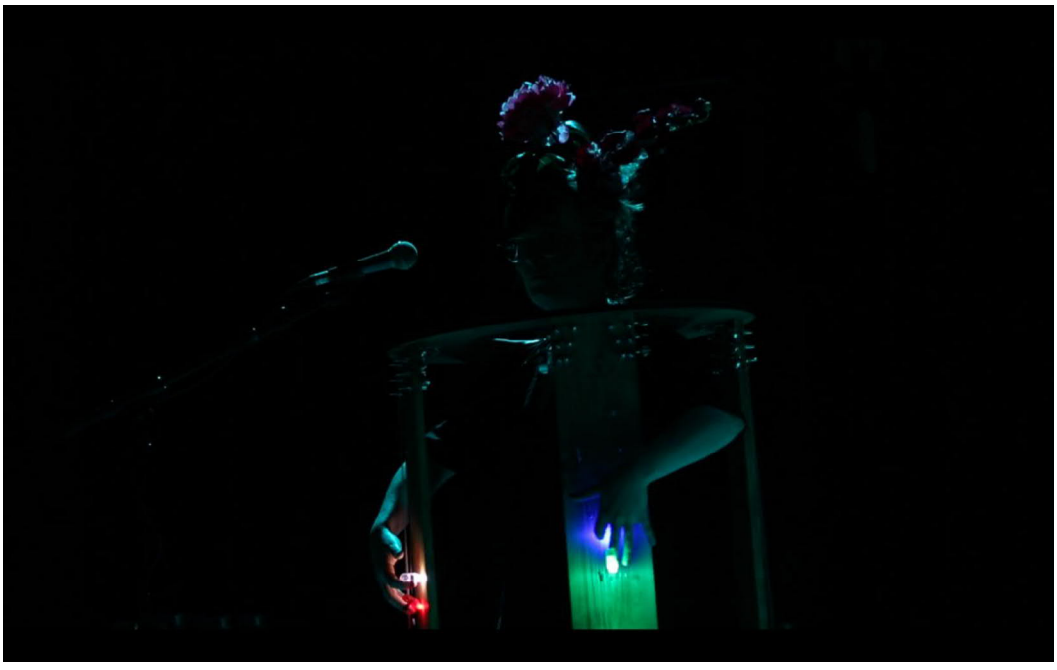
I had finished building Kehäkitara just a week before my master's concert, so I did not have a lot of time to practice with the new instrument. I had prepared two of the necks with blu tack to have a bit more sonic nuances in each neck. I had decided a certain structure for the performance: I would

start slowly plucking just one string at a time and then I would introduce each of the four necks separately by turning all of the necks one at a time to be in front of me. During this introduction I would also move from the back of the stage to the front of the stage. I had put some plastic flowers to my hair so that I could hit the hanging windchimes with my head movements when I was near them. With this floral head extension, I could reach further to the space – so my body would be even more extended than with just instruments within my body.

After the introductory part to Kehäkitara, I stationed myself near a foot switch MIDI controller in front of a microphone stand. My plan was to loop the sound of Kehäkitara and I was using SoftStep 2 MIDI controller to trigger the starting and ending points of each loop. I describe in chapter 5.2 more in detail how the loop patch was designed and how it functioned, so please see further information from there. The sounds in the loops were changing, they were played in different speeds and sometimes also reversed.

Apart from the looping, I was controlling singing through the footswitch controller. I had been working on a Max patch that can freeze a sound – take a sample and keep playing the same sample again and again to create an effect where one sound keeps the same for a long time. I was using the freezing effect to my singing with different kind of vocal effects liki hissing "sss", rolling "rrr" as well as small melody fragments from where I took one pitch to be frozen.

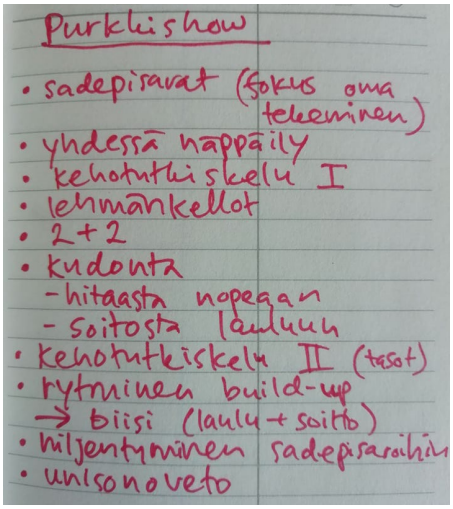
I wanted to make a dramatic transition with the lights in the end of the performance. I found from a party shop "finger lights", small battery-operated lights in each finger, and I decided to use them to play Kehäkitara. I asked the light technician to fade the general lights away so that only these finger lights would be seen – this shifted the focus really to the strings of the guitar as well as the fingers of the player. Finally, I switched off the lights one by one which created a complete blackout before the last part of the concert.



Before the final act there was a small break while me and "Can ensemble" were getting ready. Can ensemble consisted of four players: me, Fanni Lehto, Maiju Lehti and Noora Salmi. All the players are singers and musicians, and we are also very close friends.

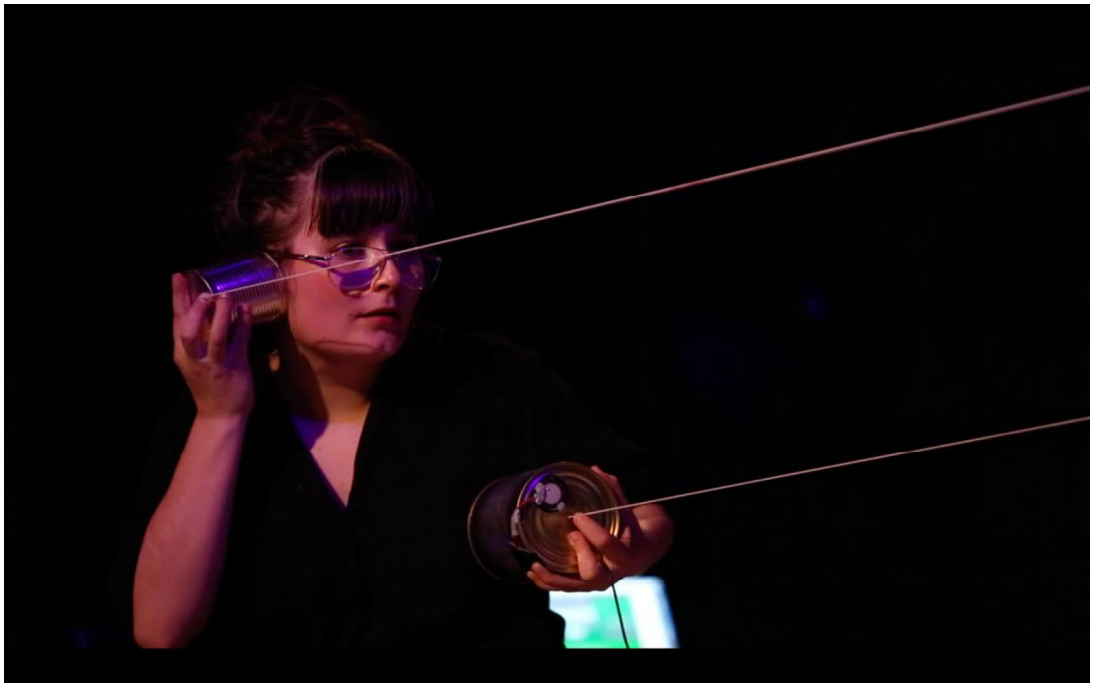
Our performance had quite preplanned structure that we had planned and practiced together two times. The structure was as follows:

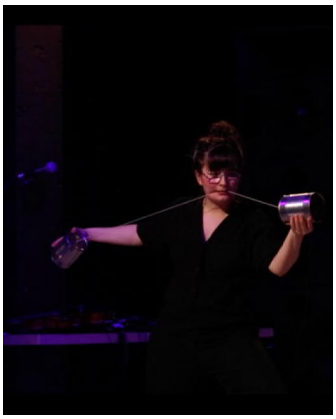
- Raindrops (focus on your own doing)
- Plucking together (synchronize)
- Body Research I
- Cow bells
- 2 + 2
- Knitting
    - from slow to fast
    - from playing to singing
- Body Research II (in layers)
- Fading out to Raindrops
- Unisono drag



Performing with these people was fun and inspiring. I think the clear structure made the performance nicely tight. I was the leader of when to go on to the next event, but I think otherwise we had very nice balance in the group: we were listening to each other and reacting to each other. I think personally I was bodily most free and relaxed while playing Tölkit in my master's concert. I was even taking some risks with the instruments – doing things that I wasn't sure are they going to work and how it will sound. Compared to Viuluvartalo and Kehäkitara, Tölkit as an instrument is simple, and the body can be very free while playing because nothing is attached to the body and the instrument doesn't strain the body with its weight. I think the simplicity encourages to be playful – which is also related to being comfortable because playing in an ensemble with friends. The fact that it was also the last part of the performance was also mentally reassuring, I knew the performance would be soon over and I could try to give all the energy I got left in me to the performance.

During the rehearsing period and the performance, it was very nice to try to plan the direction of focus. In Viuluvartalo I was focusing on my fingers and in Kehäkitara to the audience – so in Tölkit I wanted to focus on the ensemble and my whole body. None of us players were very familiar with bodily approach to music making so it was fun and interesting for each of us to find ways to explore the body – what are all the ways we can play this instrument. The physical and performative approach was new for most of us and stepping to an unknown territory felt like a good thing. The ensemble members are all very good singers and I wanted to incorporate that to the performance in some way. After trial and error, we decided to approach voice also from an explorative angle – using voice as it is part of the bodily research, how can I use my voice, how can I use my throat, how can I use my lips? In the performance there is actually surprisingly little amount of singing and this was something I did not expect first, my assumption was that with an ensemble of four singers we would like to do more dense vocal textures. In our rehearsals it was difficult to find a fitting approach to singing together, it easily went to either a cappella group style of looping or to absurd free voice improvisation. This is something that in the future could be developed further – how we would find a natural way to sing together with Tölkit.





Overall, I was very happy with how the concert went. It was great to perform in a good venue with sound and light technicians. The previous performances with Ihmiskehonjatkesoittimet had all had some kind of compromises considering the venue and the technical aspects, and I think it affected a lot the mental side of the performing – now I could actually focus on the performing. This time I had also the venue for myself for several hours, so it was good to have time to set-up the space and to get to know the space. I think in a performative concerts like this, it is very beneficial to have the ability to use the space to its full capacity and the let the space to act as inspiration for the performance as well, for example the podiums and the coat rack came to be important parts of the performance just because I found them in the venue. All this was possible because the space was booked only for my concert and I had had correspondence with the technicians before – the whole concert was in that sense very well planned, and from my point of view it was luxurious to have this space and help available for several hours.

There were some things that of course could have gone smoother and these are things I will consider more in my future gigs with these instruments. First of all, I need to reconsider if it is safe to use the clock in Max to time events. I've heard that the clock can be a bit unreliable and I think in some cases that is not acceptable. In this performance it wasn't so important to have so accurate timing on things, but it would have of course made things easier if it would have worked the way it was planned. I got slightly worried about the time while I was performing, but I was really trying to hide that during the performance and after talking with people it seemed that they hadn't noticed anything about Viuluvartalo being too long. Using so much time on the first performance made an impact to the other performances which wasn't so good. I felt I was a bit rushing through Kehäkitara and since I was the leader in Tölkit – I was also a bit in hurry to get through the performance. I think the whole thing worked all in all, but maybe from the point of view of proportions of the separate acts it was a bit unbalanced – Viuluvartalo was the same length as Kehäkitara and Tölkit together. This is

something that I can think in the future – if I notice a technical failure of this sort, maybe I want to interfere with it so that the whole structure of the concert is not affected by it. Then again, by listening and watching the documentation of the concert, it doesn't feel like Viuluvartalo was somehow unnecessary long. I think the wisest thing would have been to just live with the fact that for some reason the first act was longer, but not let it affect the durations of the other parts of the performance.

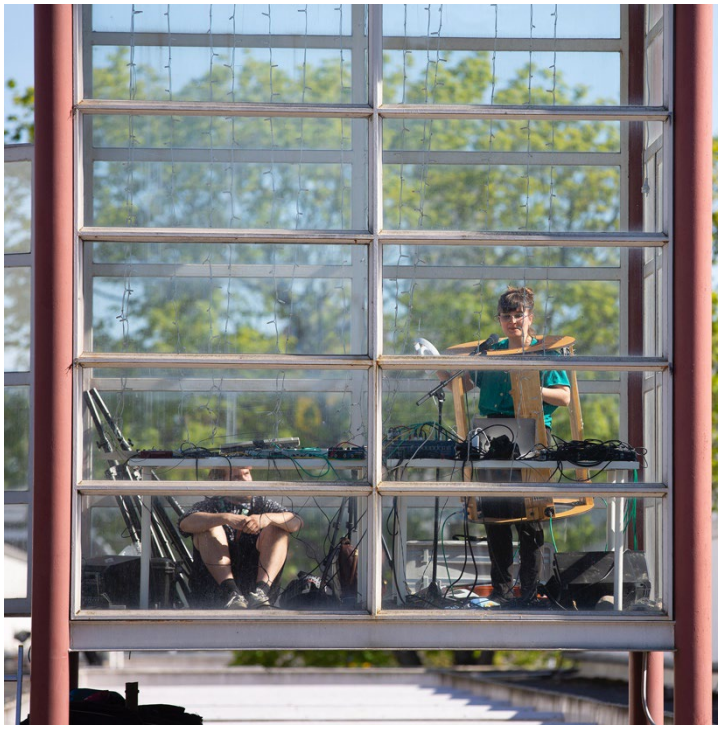
The atmosphere in the concert was nice and encouraging. I had some problems with hitting the windchimes with the flowers in my head, but with the audience it became a humourous moment – not anything that I would have considered as fault. I remember getting generally nice feedback after the concert, but someone was commenting on that Tölkit could have been louder. This was a relevant point and the reason for rather considerate volume levels in Tölkit, was because they were easily feedbacking in the space. We did not have feedback problems in our rehearsals, but with the speaker configuration in Kallio Stage it became a problem. For that reason, we needed to use more the side speakers than the front speakers and that made it a bit hard to hear oneself and others. In future, I would like to take a further look into building and using contact microphones. In my tutoring session with Marianne we had been discussing about doing equalization to the sound of contact microphones, but in this schedule, I did not find time to have delve into that. Furthermore, I have been building contact microphones often with unbalanced audio, but the sound technicians were commenting that balanced audio signal would be more reliable. This would be equally easy to build, so I think I will construct my future microphones balanced audio signal and see if I get better results.

6.6 Kontula Electronic festival: Kehäkitara and viola

General information:
18.5.2019 at 16:30
Kontula Electronic festival,
Kontula shopping mall / Lasikoppi Helsinki
Performance duration: 30 minutes

The performance venue in Kontula Electronic festival was one of the most special ones I've seen so far: it was a glass box in the rooftop of a shopping mall. I decided to play a set with Kehäkitara and viola.

Unfortunately, I had some trouble with the magnetic pickups while testing the Kehäkitara at home. For that reason, I decided to add two contact microphones to the guitar to quickly fix the problem with the humming of the humbuckers. This changed the sound a lot: with the contact microphones the whole instrument became a surface that was heard and I could play rhythmical patterns by tapping the wooden structures of the instrument.



Because the venue was high up, there were some challenges with the roading – how to get all the instruments up via a ladder. The venue was also difficult from the point of view of hearing, the sound engineer was down by the street level and I had monitor speakers inside the glass box. During the soundcheck we had some major problems with me hearing and in the end, I decided to use headphones as my monitor. The uncertainty of how I

heard compared to how it sounded made me feel uncomfortable throughout the whole performance.

My approach to this performance was very much sound based. I was playing through the computer some slowed down samples and on top of that I was doing live looping both with Kehäkitara and viola. The emphasis on sonic performance had several reasons, some of it had to do with the fact that I got quite immobile in the glass box. The small size of the venue and the problems with the headphones being stuck to my ears made me be bodily quite still. The audience was also far from me, so I felt it was difficult for them to see what I was doing. The distance made it also almost impossible for me to have contact to the audience.

To conclude, I think the gig itself was a success. There were of course some inconveniences with hearing and also the glass box got very warm which was uncomfortable – but these felt like minor problems. This gig was the first very public performance with Kehäkitara and I think the audience was mostly interested in the instrument. Kontula Electronic festival had already before the gig aroused some media attention to my performance by mentioning it in radio programs and papers. After the performance I got positive feedback from audience and in a news story about the festival, a boy described my music as “soft cloud music” (Alaja 2019).

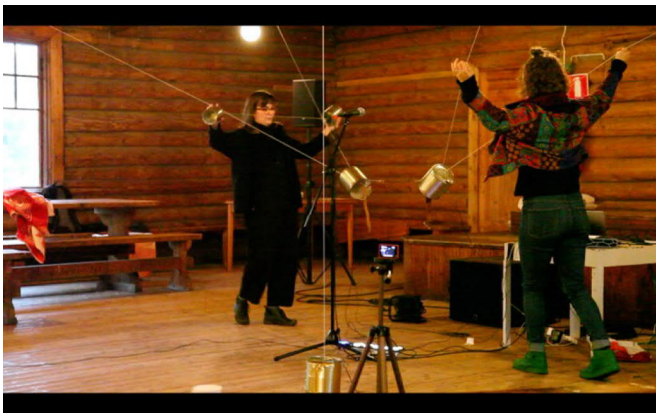
6.7 Lammassaari Site-specific: Tölkit

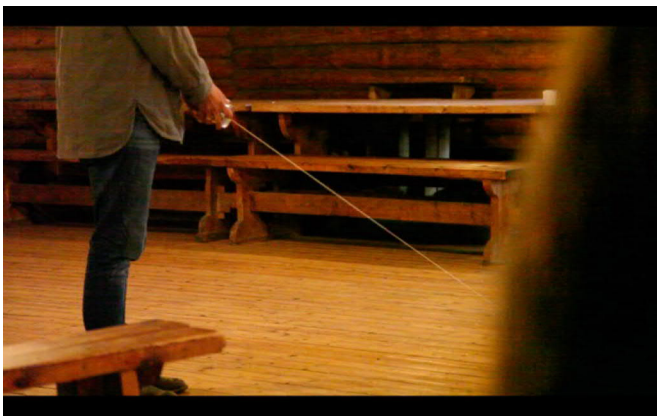
General information:
26.5.2019 at 19:45
Lammassaari Site-specific festival organized by Äänen Lumo,
Lammassaari Pohjolan Pirtti Helsinki
Performance duration: 30 minutes

The performance in Lammassaari was part of a site-specific sound art festival. I decided to try out a completely new approach with Tölkit by turning them into a sculptural installation. I contacted a pizzeria in order to get bigger sized metallic cans to produce more of the can instruments.

The concept for the performance was to make an installation of the cans that would turn the venue into a big string instrument. The venue, Pohjolan Pirtti is a wooden house in Lammassaari island and the way the house is build was very suitable for hanging out metallic cans since the ceiling is constructed with big wooden logs. I wanted to try out an approach of including the audience to the playing and exploring. I ended up making a list of Eight Commandments that would guide the performance:

1. Throughout the whole performance you can play or listen – playing is voluntary.
2. Pluck the string once in a while, listen to others and give space.
3. Try to play at the same time as the performer.
4. Try to find a new sound from the can.
5. Let someone else play or take a break.
6. Sing or say consonants (for example rrr, sss, fff, kkk, ttt) to the can.
7. Try to play the string with a different body part.
8. Freestyle! You can find inspiration from 1.-7. Remember also to listen to others.





Setting up the cans in the space took approximately three hours and everything sounded nice in the soundcheck. During the performance there was major technical problems, which basically ruined the performance from my point of view. I was using the same Max patch that I had developed for my master concert and I was also using the Freeze patch for singing. In addition to those, I had prerecorded some sounds from the cans and made a track that was rich on the bass frequencies – to give a bit wider ambitus to the sound since the sounds from the cans are mostly mid or high frequencies. The problem was that apparently I had two sample rates going on to the audio interface at the same time and that caused a weird distortion to the sound, nothing sounded the way I had planned. I could not figure out this problem in the moment, so I ended up giving a very distorted concert.

The interactivity with the audience was working quite well: the audience members were exploring the possibilities to play the cans and it seemed like they had fun. The

atmosphere was sometimes a bit chaotic, but I was expecting that since I gave almost free hands to the audience. I had explained before the performance started that I will conduct the improvisation sometimes by showing numbers with my fingers. That worked well in the beginning of the performance, but in the end the focus was a bit lost – one reason being the distraction of the technical issues with the sound distortions. Therefore, I lost the contact with the audience for maybe 5–10 minutes and they forgot that I was supposed to sometimes give them instructions of what to do.

I didn't feel this was a successful performance, I felt actually quite embarrassed about it. I was sad that I had let the technical problems affect my performance so much – I got really distracted by them. The idea of the interaction worked to some degree and I think these kinds of experiments are always interesting, partly because you never know what the outcome will be. After talking with the audience there was some positive feedback, they had enjoyed playing and exploring with the cans. Since the focus was most of the time in themselves – they forgot to watch my hand gestures for conducting the score and they were not also so aware of my technical problems. This was of course interesting and comforting to hear, but I will certainly plan a bit better the way how to interact with the audience the next time I will be doing similar performance.

7. Findings and reflection

Ihmiskehonjatkesoittimet turned out to be three experimental string instruments, each of them having a different design approach. This written thesis explains the process of design, building and performing with the instruments through my own reflection. To contextualize my work, I have explained works by other artists that gave me inspiration and how my work relates to their pieces. The thesis briefly sheds light on ergonomics, because it relates to my decision to choose this topic.

It is difficult to draw conclusions of all the three instruments because of their individual approaches. I regard the three instruments as a part of thematic series of Ihmiskehonjatkesoittimet and therefore I don't see the work as a triptych, it is rather a collection of instruments. That's why this reflection section starts by viewing the instruments individually by trying to relate these instruments to other works I have introduced in this thesis and answer the set research questions. The results of the research are recapitulated in a table which compares the key elements of each instruments again according to the research questions (subchapter 7.4).

7.1 Viuluvartalo: found object strapped to a free and cautious body

Viuluvartalo is an instrument that could be regarded as a found object when thinking of its process of becoming an art piece, or in this case an experimental instrument. It could be also argued, whether Viuluvartalo is really a new instrument, but by relating it to the canon of readymade art which is based on ordinary objects that are presented either as works of art themselves or through the modification of the artist (Da Cunha Lewin & Nichols 2019) – I can state that Viuluvartalo is a new instrument. The aim of the instrument was to reimagine ways to play violin and also to make a statement about the unergonomic playing positions of the instrument with playful manner. Designing the instrument consisted mainly on planning how

the instruments would be attached to the body and deciding on what objects to play the violins with – this was a process that expanded my knowledge and enthusiasm about violin playing. Playing the violins with different objects was a fascinating path to take, I had never imagined exciting the strings of violin with for example artificial hands or flowers.

While playing Viuluvartalo, the body explores freedom in movement even though the instrument itself creates some restrictions on movement. While I was performing with Viuluvartalo, I was feeling rather free in my body, but I was still aware of wearing rather valuable and fragile instruments. Especially the risk of making the instruments collide into each other was something I was trying to avoid. My body wanted to find ways to isolate the lower and upper body – this worked well both visually and it felt good to explore the playing through the movements of the torso. Different kind of hand gestures worked also well, and they gave interesting sonic results, I ended up creating both sounds that I have never heard played on a violin and that I have never played myself.

The principle of Viuluvartalo is very similar to other instruments that are strapped to the body. The relation to the electric guitar is both visually clear and sonically thinking, the amplification of the instrument can refer to electric guitar as well, even though the timbre itself doesn't suggest a clear resemblance. One concert organizer even described me to be "the Jimmy Page of modern music" with Viuluvartalo and the comparison doesn't seem to be far-fetched, since Page is a rock guitarist who performed with a two-neck electric guitar. The difference with other strapped instruments and Viuluvartalo is that violins are not designed to be strapped, so the attaching mechanism that I created is a compromise and rather insecure. The fragileness of the mechanism is of course mainly felt by the performer, but I think it might be conveyed to the audience as well. Violin as an instrument has strong cultural connotations and as an object it is delicate and expensive – my assumption is that from the audience viewpoint Viuluvartalo is quite

daring instrument, lingering on the edge of fragility. Another aspect that connects Viuluvartalo to the tradition of found objects in fine arts, is that Viuluvartalo reshapes the purpose of a violin and creates meanings through the naming of the piece (Da Cunha Lewin & Nichols 2019). The instrument is not played conventionally but instead rather provocatively, hinting even with the name of the instrument that the object and the player could be seen as a hybrid, Viuluvartalo (in English Violin Body).

7.2 Kehäkitara: wearable and surrounding instrument weighing down a rotating body

On the contrary to the relatively simple readymade construction of Viuluvartalo, the design and building of Kehäkitara was a complicated process. Comparing Kehäkitara to the other works introduced in this thesis results in finding similarities in many aspects. First of all, Kehäkitara is a wearable instrument, even though the hard material usage does not suggest similar kind of wearability as in sounding clothes. The works by Benoit Maubrey are dealing with harder materials, but unlike for example Maubrey's Audio Ballerinas (Maubrey 2011; Knotwe), Kehäkitara's movability has restrictions because of the attached audio cables. It could be mentioned that in general, the ability to move while playing each Ihmiskehonjatkesoittimet-instrument is restrained because of the audio cables.

The body is surrounded by Kehäkitara which is reminiscent to both acoustic instruments surrounding the body, e.g. sousaphone (Bierley 2006; Pagliaro 2016, 3–4, Encyclopaedia Britannica 2017) or saxtuba (Bevan 1990). The sound production mechanism is though rather different, even though Kehäkitara can be heard partly acoustically, it is designed to be amplified. Also, the marching band function of sousaphone and saxtuba doesn't apply to Kehäkitara, walking with the instrument is difficult because of the limited space for the legs.

Instrument surrounding the player also hints to Stelarc's massive constructions, like Exoskeleton, The Muscle Machine and Stickman, where he is situated inside the sculpture. The scales of the pieces are different, Kehäkitara weights approximately 11 kg whereas for example Exoskeleton is 600 kg. A shared idea is the spatial sound with a sonic object surrounding the player, but when Kehäkitara's multichannel looper diffuses the sound with a predecided manner – Stelarc's Stickman distributes the sound to a ring of speakers with an algorithm with 64 possible combinations. As I understand it, in Stelarc's piece the algorithm moves the robotic limbs that have sensors giving information about the position of the limbs. This information is then given to computer software Max, which then plays the sounds in the speaker according to the position of the limb. (Stelarc 2018; Stelarc 2017.) The idea is somewhat similar to mine – the instrument has sound sources towards many directions and the spatiality of those sounds is emphasized through the spatial amplification. It seems that Stelarc does this more accurately, basing the spatiality on the sensory data whereas in Kehäkitara the spatial accuracy is not in the center of attention. In a broader scope, the use of technology and the use of body are very different in these art pieces. Stelarc wants to be controlled by the technology and his body becomes insignificant, a dramatic tool to showcase the power of technology, whereas in Kehäkitara, I wanted to keep the technology as a tool that has even quite a minor and transparent role, that the focus would be on the player and the instrument as a unity. With Kehäkitara, I'm forming music near my body and sending it to surround the audience – and after it has been sent to speakers, then Max begins to shape the sound to its own journey to surround the audience and changing the sound gradually through manipulation.

Apart from the design of the instrument, another key question is to answer to how the body behaves with the instrument. In the case of Kehäkitara, there are definitely hindrances with the movement with the instrument. The structure of the instrument is basically a cage and that was a conscious choice, I was inspired for example by The Remote Control II-piece by Jana

Sterbak, where a body is put into an aluminum caged structure with motorized wheels that are controlled both by the person in the crinoline as well as by others (Nembhard 2017; MACBA 2007). Sterbak, like Stelarc, is interested in her piece to research the control on human body, but Kehäkitara is clearly operated by the player itself and the structure of the instrument makes some restrictions of the musician's control. For example, the legs have a limited moving space within Kehäkitara and the plywood upper part of the instruments blocks the view to the necks of the instrument, which makes the playing challenging. Even though the hands are not seen by the player, the instrument can be played tactilely. Perhaps because the visual barrier, the hand gestures while playing tend to be slow and dynamic – the lack of details in the gestures is replaced by the assertiveness of the movements.

From an ergonomic point of view, Kehäkitara has problems, it is too heavy and there are some apparent design errors with the instrument. The hole for the head is too wide which makes the edges of the instrument press the shoulders uncomfortably, even though there is foam padding attached near the shoulders. I assume that a smaller neckline could have helped to even out the weight distribution on the neck area, but then again smaller hole would mean more wood and therefore more weight on the instrument. Another design error is the length of the instrumental necks, they are too long both compared to my arms and from the aspect of traveling. The instrument has unpractical dimensions, for example the neck is 81 cm long and a standard suitcase is 75 cm. Therefore – slightly shorter necks would have made (1) the player to reach the volume potentiometers of the necks, (2) the traveling with the instrument easier and (3) the instrument lighter. As my defence, the reason for doing longer necks was that I understood that the longer the guitar strings are, the longer sound vibrations are possible, and since I wanted the instrument to be able to produce low frequencies, I thought that tall necks are good. As stated earlier, developing the ergonomics of playing needs active discussion between instrumentalist and instrument builders (Blum & Peltomaa 2002, 1610–1613; Lääkäriliitto 2004) and me creating a new

instrument maybe confirms that statement – it is very difficult to build an instrument that would be right away both ergonomic and interesting. In my building project I merged many roles into one, so it's no surprise that trying to understand the ergonomics while being also the builder and the performer at the same time, can mean that some aspects of the development are challenged. With Kehäkitara the ergonomics were never in the core of designing the instrument, whereas with Viuluvartalo that could be considered as the starting point.

7.3 Tölkit: readymade toy adaptation held by a playful and flexible body

As mentioned earlier, Tölkit is not really a new construction, but an adaptation of a children's toy called tin can telephone. In that sense the instrument is similar to Viuluvartalo, based on readymade esthetics even on two layers: first layer being the original found object, tin can turned into a telephone, and the second layer being that children's toy turned into a musical instrument. The amount of meta is significant, since the tin can telephone has also its predecessors dating back from 17th century.

The body is the freest while playing with Tölkit when comparing to all Ihmiskehonjatkesoittimet. The sense of freedom relates probably to the simplicity, the durability and the cheapness of the instrument, it is possible to treat it really like a toy and not worry about breaking it. All this creates playfulness that is also accelerated by the ensemble playing the instrument – you can get inspired by others way of playing the instrument.

7.4 Table comparison of Ihmiskehonjatkesoittimet

The next two pages include a table comparison of the instruments as they were played in the master concert. Each column and row give a summarized answer to the research questions of the thesis. In the end of the chapter, a summary of the comparisons is once more paraphrased.

Instrument	Viuluvartalo	Kehäkitara	Tölkit
How is the physical instrument made?	Two amplified found objects, 1/8 violin with a contact mic and viola with a bridge piezo pick up mic, attached to the body with straps.	Sculptural design and construction consisting of wood, leather, iron and electric guitar components. An electric guitar with four vertical necks.	An amplified adaptation of a tin can telephone, an existing children's toy consisting of a metal can, string and contact microphones.
What sound manipulation is done live to the instrument by the computer software Max?	Clock-based linear design of sound manipulation consisting of growing reverb, three varying tap-delays and two alternating pitches harmonizing the root frequency.	A multichannel looper triggered by a foot MIDI controller. Looper changing the speed and direction of the sound and diffusing it to 6 speakers. As an addition to the Kehäkitara patch, an alternative to use voice and freeze the sound to four separate players.	Clock-based linear design of sound manipulation consisting of growing reverb, three varying tap-delays and two alternating pitches harmonizing the root frequency.
What is the body doing while performing?	The body is exploring isolation of upper and lower part of the body, diverse hand gestures and performing in different horizontal and vertical levels of the stage. The eyes are focusing on the hand gestures.	The body is surrounded by the instrument and finding ways to showcase 360° of the body and the instrument to the audience. The body is experimenting with rotational movements of the torso and the instrument. The hands are doing slow and dynamic gestures. The performer is focusing on having contact to the audience e. g. by looking straight to the audience. The head is trying to hit the wind chimes with the flower extension in the head.	The body is searching constantly new ways to play the instrument: it's plucking and pulling the string with fingers and mouth, it's rubbing the string to different parts of the body, it's waving the string in the air and it's singing to the can. The body is exploring the space in various horizontal and vertical levels. The body is seeking contact with the other players of the ensemble.
What is the body feeling while performing?	The body feels rather free, but aware of the fragility of the instrument. The body is excited about finding new ways of playing violins – it sometimes reaches a flow state. The body is trying to make sure that the microphone cables don't get tangled while performing. The ears are attentive that the sonic result is interesting.	The body feels restricted because of the cage construction and the instrument cables are hindering the movement of the body. The body feels strained because the instrument is heavy (ca. 11 kg). The body is motivated to play the instrument, because it's fun and wearing the instrument feels like entering a new strange body – the transformation in the body is so huge that it feels even as if the instrument would be a costume of an actor.	The body feels very free and playful. The body is not so interested in the sonic result, it is very much focusing on the movement and the other performers in the stage. The body is a bit worried about contact microphones dropping of the instrument, it is also trying to make sure that the microphone cables don't get tangled while performing.

Instrument	Viuluvartalo	Kehäkitara	Tölkit
How is the performance designed?	The performance is designed through practice and decisions about time. The time-based structure of the performance is locked in the sound manipulation in the computer software, but the sonic and gestural content of the performance is improvised. The performer has the following objects to play the violin with: two violin bows, a wooden hand, branches and flowers. The objects are situating in contrasting places in the stage in order to make the performer to use the stage widely.	The performance has an open sonic and gestural structure, but the performance has light cues in the beginning and end of the performance: the light technicians start to fade out the general lights while the performer starts to light up the finger lights. The software design allows the performer to build the music to five separate loops and freezer players effortlessly in the moment of performing. The gestures are partly preplanned in rehearsals. The placement of the two wind chimes makes the body move in the space and the placement of the singing microphone makes the body to moor into a place.	The performance has a clear structure designed by the Can ensemble in their rehearsals. The patch in the computer software and the leader of the ensemble are timing the events of the performance. Each performer has the freedom to interpret the given structure with their own wishes.
How did practicing and performing with the instrument develop me as a sound artist?	Performing with Viuluvartalo developed me as a violinist. During the rehearsal process, I learned a lot of new sounds and playing techniques. I came also more aware of the space as a solo performer – how should I plan the stage setup so that I am able and encouraged to move.	Performing with Kehäkitara made me braver of entering a stage with a certain role. Since the practice period for the instrument was so short, I needed to trust myself to make an interesting performance with other qualities than great skills with the instrument. I developed myself a kind of role of a mysterious guitar player that in a way appeared in the stage as I entered the guitar and left the stage as the darkness fell to the space.	Performing with Tölkit developed my uninhibitedness and spontaneity as a performer. The simplicity of the instrument made it easy to focus on the bodily movements and gestures. The playfulness while performing came probably both from the original context of the instrument being a toy as well as the ensemble rehearsals being so fun. Conducting the ensemble rehearsals with musicians from the point of view of performance art was also a new learning curve that taught me about how to make decisions and to give also freedom at the same time.

As the table on the previous pages show, all the three instruments have different characteristics. Only clear similarity in the design can be found in Viuluvartalo and Tölkit, as their sound manipulation in the Max software is significantly similar.

What the body is doing and feeling is changing in each instrument. Again, Viuluvartalo and Tölkit are somewhat similar, both of them respond to the original wish about finding ergonomic ways of playing. In Viuluvartalo some bodily restrictions and cautiousness remain, perhaps because of the expensiveness of the instrument, and my own history with the instrument as well as the cultural expectations on how to treat a violin. Vice versa, in Tölkit the cheapness of the instrument as well as childlike cultural connotations persuade the body to playfulness. In contrast, the aim of ergonomic playing is not fulfilled in Kehäkitara, which is heavy and cage-like instrument that causes strain and challenges for the body. On the other hand, the bodily transformation is so extreme, that it gives the body an encouragement to explore both physically and mentally the new circumstance.

Overall, rehearsing and performing with the instruments from the point of view of performance art developed me greatly as a musician – the discussions with performance artist Leena Kela and sound artist Marianne Decoster-Taivalkoski were eye-opening. The gained insight on performance has been affecting my performing and it has reached also to other areas of my work, for example composing includes nowadays always thinking on how the musicians are on stage.

8. Conclusion

Ihmiskehonjatkesoittimet was an ambitious project that developed me as creator and performer. I learned many practical skills while building the instruments and designing the patches in the software environment. I feel I reached my goal of building instruments that are durable and innovative, even though there is certainly room for improvement. Planning a whole concert was a new learning curve me, which taught me also productional skills that will be useful in future. As a performer I think that I have a new perspective to think about my own presence on the stage – and this has also affected how I write music for others. I could say that the project matured me generally as a performer and musician, the process was fun, but of course at times very challenging. I feel I will definitely continue this project in future – I have still more ideas that I would like try within the topic of extending the body with musical instruments and the comments from others are encouraging, people are interested in these instruments and I'm getting possibilities to perform with them both in Finland and abroad, for example in Norway and Estonia.

Embodiment in music and wearable instruments are popular research topics at the moment, and I believe my thesis is nicely touching upon these phenomena from the angle of artistic research. There are many interesting aspects that were not tackled in this research. Many ideas about instruments were still not realized, so future research could focus on creating new instruments from a different viewpoint. My standpoint with multiple roles in the thesis project, being the researcher, the builder and the performer gave me a good overview of the process, but it hindered me from seeing things from some other perspectives. This could be an interesting topic for future research, how would a performer treat an instrument extending the body, if someone else would have been the designer of the instrument. This research was focusing on physical body extension, but the idea of body extension could be taken further. For example, combining the sensory data of the human body

to physical extensions could provide interesting artistic projects that would be dealing with both the inner and outer dimensions of the human body.

All in all, Ihmiskehonjatkesoittimet is perhaps the longest and most personal art project I have done so far. Performing with the instruments intensively and writing about the process has been rewarding – it has taught me to be critical but compassionate towards my own work.

I hope that my thesis can give inspiration and knowledge to other artists and instrument builders as well. The thesis shows concretely the struggle and joy of playing: performing with Ihmiskehonjatkesoittimet is kind of a mise-en-scène of both the physical challenges that playing an instrument brings and at the same time – how exciting and fun playing can be.

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10. List of figures

11. Appendix:

Documentation video of the master’s concert

https://www.tyttiarola.com/ikjs-documentation

password: surroundguitar